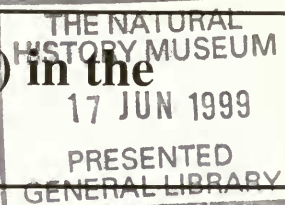


The moss family Calymperaceae (Musci) in the Philippines

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SYNOPSIS. A taxonomic account is presented of the nonleucobryoid genera in the moss family Calymperaceae occurring in the Philippines. Four genera are recognized: *Calymperes* (18 species), *Chameleion* (1 species), *Mitthyridium* (8 species) and *Syrrhopodon* (19 species). Keys to taxa are provided. Species newly recorded for the Philippines include *Calymperes mangalorensis* Dixon & P. de la Varde, *C. motleyi* Mitt. ex Dozy & Molk., and *C. subintegrum* Broth. *Mitthyridium fasciculatum* var. *cardotii* (M. Fleisch.) A. Eddy is raised to the rank of subspecies (*M. fasciculatum* subsp. *cardotii* (M. Fleisch.) B.C. Tan & L.T. Ellis).

INTRODUCTION

The family Calymperaceae is a group of tropical mosses mainly confined to lowland and coastal forest communities. Its diversity and distribution worldwide have recently been reviewed and mapped by Reese (1987b). Regional monographs of this family are available for southern India (Ellis, 1989), Malaysia (Reese & Mohamed, 1985; Reese, Mohamed & Mohamed, 1986; Mohamed & Reese, 1985), Borneo (Menzel & Schultze-Motel, 1990), Papua New Guinea (Reese, Koponen & Norris, 1986) and Australia (Reese & Stone, 1987, 1995). It is in the light of these new publications that a revision of the family was conducted for the Philippine archipelago based on the large collections made by the second author in recent years.

There have been attempts to redefine the family Calymperaceae by the inclusion of several genera, such as *Leucophanes* and *Exodictyon*, in which the species possess leucobryoid leaves (see review in Reese, Koponen & Norris, 1986). Although the arguments presented are not agreeable to many, these new treatments of the family have much merit. However, in the present work we have chosen to include only the four genera with species that possess nonleucobryoid leaves, namely *Calymperes*, *Syrrhopodon*, *Mitthyridium* and *Chameleion*. The last one is a segregate genus of *Syrrhopodon* (Eddy, 1990).

An early account of the Calymperaceae occurring in the Philippines can be found in Bartram (1939), who reported a total of three genera and 33 species. Iwatsuki & Tan (1979), in their checklist of Philippine mosses, report four genera and 35 species. This study recognizes four genera with 45 species. Three species are new records for the Philippine flora, namely, *Calymperes mangalorensis*, *C. motleyi* and *C. subintegrum*. Except for *C. mangalorensis*, which

was known only from a few localities in India and Myanmar (Burma) before its discovery in the Philippines, these are widespread species in tropical Asia. Their presence in the Philippines is therefore not surprising. On the other hand, there are four taxa whose alleged presence in the country cannot be confirmed by the present study (see excluded taxa). The increase in the number of species from 33 to 45, and the data from the new collections made by the second author, represent a great improvement in our knowledge of the high diversity of the family Calymperaceae in the Philippines.

Phytogeographically, the species of Philippine Calymperaceae can be grouped into the following six categories:

1. Pantropical – 8 species (c. 17%), *Calymperes afzelii*, *C. erosum*, *C. lonchophyllum*, *Syrrhopodon gardneri* and *S. parasiticus*.
2. Palaeotropical to Oceania – 7 species (c. 15%), *Calymperes serratum*, *C. taitense*, *Syrrhopodon armatus*, *S. involutus*, *S. spiculosus*, *S. trachyphyllus* and *S. tristichus*.
3. Indo-Pacific – 21 species (c. 46%), *Calymperes aeruginosum*, *C. moluccense*, *C. motleyi*, *C. porrectum*, *Mitthyridium constrictum*, *M. flavum*, *M. repens*, *Syrrhopodon albobaginatatus*, *S. confertus*, *S. croceus*, *S. japonicus* and *S. muelleri*.
4. Malesian-Pacific – one species (c. 2%), *Mitthyridium subluteum*.
5. South India, Indochina, SW China and Central Malesia disjunct – 4 species (c. 9%), *Calymperes mangalorensis*, *Chameleion peguense*, *Syrrhopodon flammeonervis* and *S. tajibodensis*.
6. Malesia – 4 species (c. 9%), *Calymperes robinsonii*, *C. subserratum*, *Mitthyridium wallisii* and *Syrrhopodon rufescens*.
7. Philippine endemic – one species (c. 2%), *Mitthyridium iwatsukianum*.

From the above analysis it is evident that the majority (c. 46%) of

Philippine Calymperaceae are widely distributed from tropical Asia to Oceania. About 17% are pantropical and 15% are palaeotropical in distribution. Only 9% (four species) are restricted to Malesia, one species is Malesia and the western Pacific, and one species, *Mitthyridium iwatsukianum*, is locally endemic to Luzon island. This overall distribution well reflects the predominantly coastal distribution and preference for an epiphytic lifestyle in lowland habitats among members of this family. Species of Calymperaceae must be efficiently wind dispersed to achieve such a broad range. Evidence is seen in the frequent production of gemmae at the tips of leaves; in many species some leaves become strongly modified for the production of gemmae (see also Reese, 1987b). However, a few species, such as *Calymperes mangalorensis*, *Chameleion peguense* and *Syrrhopodon tjibodensis*, notwithstanding their gemma-producing capabilities, appear to have failed to disperse very far. They have some limitation that has resulted in their present-day disjunctive range in India, Indochina, SW China and a few island groups in central Malesia, where seasonally dry lowland rainforest predominates.

SYSTEMATIC ACCOUNT

Calymperaceae Kindb., *Gen. Eur. N.-Amer. Bryin.*: 11 (1897). Type genus: *Calymperes* Sw. ex F. Web.

Shoots erect or creeping, forming cushions, tufts or mats on trees, rock and soil. Leaves mostly linear, lingulate or lanceolate. Costa strong, ending just below apex or excurrent, smooth, toothed, spinose or ciliate; in nonleucobryoid genera usually composed of dorsal and ventral bands of stereids separated by 1–2 or more layers of guide cells (in leucobryoid genera largely composed of large, empty hyaline cells supporting networks or layers of small chlorophyllose cells), superficial cells often differentiated. Lamina in basal region of leaf composed of large, empty, thin-walled, porose hyaline cells; above basal region composed of small, thick-walled chlorophyllose cells (sometimes incorporating hyaline cells), smooth, toothed, spinose or papillose. Leaf margin often with a marginal or intramarginal rib, entire, toothed, papillose, spinose or ciliate. Clavate to fusiform, multicellular, mostly uniseriate gemmae often produced from a definite region of the costa (usually the apex), sometimes on specialized leaves. Dioecious. Sporophytes terminal; seta smooth; capsule usually cylindrical. Peristome haplolepidous (sometimes absent or reduced) and calyptra fugacious (*Syrrhopodon*, *Chameleion* and *Mitthyridium*), or peristome absent and calyptra persistent (*Calymperes*).

Key to genera and species

Note: This key includes four taxa which are highly likely to occur in the Philippines, *Calymperes crassinerve* (Mitt.) Jaeg., *Mitthyridium junquilianum* (Mitt.) H. Rob., *Syrrhopodon prolifer* var. *albidus* (Thwaites & Mitt.) S. Orbán & W.D. Reese, and *S. prolifer* var. *toesaensis* (Cardot) S. Orbán & W.D. Reese. However, as the authors are presently unaware of collections of these taxa from the study area they are not featured in the detailed descriptions of taxa in this paper.

- 1 Plants with erect shoots, branched or simple; leaf margins various Key 1: **Calymperes**, **Syrrhopodon**, **Chameleion**
- Plants with creeping main shoots and ascending branches; leaf margins largely formed (extending from leaf base to near apex) by a flattened, mostly unistratose* band of stereids Key 2: **Mitthyridium**

Key 1. *Calymperes*, *Syrrhopodon* and *Chameleion*

- 1 Leaves linear, costa and marginal ribs covered with irregular nodules of small chlorophyllose cells in more or less transverse rows (Fig. 9b, c, f, g) **Calymperes strictifolium**
- Leaves linear or not, lacking irregular nodules of small chlorophyllose cells 2
- 2 Leaves linear above hyaline base; cells immediately above hyaline lamina in leaf base shortly subrectangular, smooth, red, with thick, pitted walls, distinctly larger than the cells of the chlorophyllose lamina above (Fig. 18e) **Syrrhopodon croceus**
- Leaves linear or not; cells above hyaline lamina not differentiated as described above 3
- 3 Leaves soft, lingulate to spatulate, with long, remote cilia on costa and leaf margin; dorsal and ventral surfaces of chlorophyllose lamina smooth and flat (Fig. 16g–i) **Syrrhopodon ciliatus**
- Leaves variously shaped, lacking cilia, or if cilia present, then cells of chlorophyllose lamina protuberant and/or papillose 4
- 4 Hyaline lamina often occupying two thirds or more of leaf blade and/or hyaline cells continuing distally from hyaline lamina to near leaf apex, underlying the chlorophyllose lamina in 1 or 2 rows adjacent to costa (Fig. 18m, o) 5
- Hyaline lamina occupying less than two thirds of leaf blade; chlorophyllose lamina without underlying rows of hyaline cells adjacent to costa 7
- 5 Leaves 1.5–3.5 mm long with a short, but distinct chlorophyllose limb; margins denticulate from shoulders to apex **Syrrhopodon confertus**
- Leaves 1–1.5 mm long, lacking a distinct chlorophyllose limb; margins largely entire (small teeth sometimes evident near leaf apex) 6
- 6 Leaves suberect to erecto-patent; peristome teeth papillose **Syrrhopodon involutus**
- Leaves suberect to patent-recurved; peristome teeth finely striate **Syrrhopodon rufescens**
- 7 Distal extent of hyaline lamina poorly defined (showing a gradual transition from large hyaline cells in the base to small chlorophyllose cells in the distal leaf) (Fig. 8f); shoots usually acaulescent; leaves linear 8
- Hyaline lamina sharply defined with large, thin-walled hyaline cells abutting small, thick-walled chlorophyllose cells (Fig. 10g); shoots acaulescent or not; leaves linear or not 10
- 8 Leaves erect, bristle-like (wet or dry); margins above leaf base polystratose and largely entire **Syrrhopodon aristifolius**
- Leaves variously incurled when dry, strap-like; margins above leaf base unistratose and entire or, polystratose with well-developed, uni- to multicellular, often double teeth 9
- 9 Leaves <10–20 mm long; margins above leaf base polystratose, toothed **Calymperes serratum**
- Leaves c. 5 mm long; margins above leaf base unistratose, entire **Calymperes subserratum**
- 10 Leaves lingulate, less than 3 mm long; lamina on either side of hyaline region in leaf base formed by a broad band of rounded-quadrate/shortly subrectangular cells with thickened angles (Fig. 5k) 11
- Leaves various; hyaline region in leaf base bordered on either side by narrow marginal (Fig. 24d) or intramarginal (Fig. 1i) rib of thick-walled linear cells 12

*Polystratose in the Indonesian species *Mitthyridium retusum* (Besch.) W.D. Reese.

- 11 Cells of chlorophyllose lamina rounded, collenchymatous, mostly 8–20 × 7.5–15 µm; costa ending below leaf apex; gemmae produced from ventral surface of costal apex **Calymperes motleyi**
Cells of chlorophyllose lamina polygonal, not collenchymatous, mostly 7–12(–14) × 5–10(–12.5) µm; costa usually excurrent with gemmae produced from all around the tip **Calymperes tenerum**
- 12 Hyaline leaf base with intramarginal band of thick-walled, linear cells (Figs 1i, 3b, h) 13
Hyaline leaf base with marginal rib of thick-walled linear cells (Figs 20m, 24d) 28
- 13 Costa in cross-section with 2 or more layers of guide cells (Fig. 1f) 14
Costa in cross-section with a single layer of guide cells (Fig. 2e) .. 17
- 14 Leaves broadly linear, at apex abruptly narrowing into a linear proboscis (Fig. 10e) **Calymperes taitense**
Leaves narrowly linear or strap-like, at apex tapering to a blunt to acute tip 15
- 15 Leaves strap-like, <9–>15 mm long 16
Leaves bristle-like, up to 7.5 mm long **Calymperes aeruginosum**
- 16 Lamina abruptly narrowing into costa for a short distance above the hyaline base, giving leaf a petiolate appearance **Calymperes robinsonii**
Lamina not narrowing into costa above hyaline base **Calymperes lonchophyllum**
- 17 Lumina in cells of chlorophyllose lamina not or hardly protruding dorsally or ventrally (walls papillose or not), subrectangular in cross-section (Fig. 3e) 18
Lumina in cells of chlorophyllose lamina protruding ventrally, thumb-nail- or shield-shaped in cross-section (Fig. 3l) 20
- 18 Leaves dimorphic, with erect, bristle-like gemmiferous leaves and recurved, lingulate nongemmiferous leaves **Calymperes porrectum**
Leaves not dimorphic, all linear-lanceolate, lanceolate or strap-like 19
- 19 Leaves strap-like, <9–>15 mm long; shoots usually acaulescent **Calymperes lonchophyllum**
Leaves lanceolate to linear-lanceolate, 5–7.5 mm long; shoots with well-developed stems **Calymperes fasciculatum**
- 20 Costa excurrent; leaves hardly dimorphic, gemmae (when present) produced from all around the costal apex 21
Costa ending just below leaf apex; leaves dimorphic (gemmiferous and nongemmiferous); gemmae produced from the ventral surface of a modified costal apex 22
- 21 Rib bordering lamina in distal leaf intramarginal (bordered by 2–4 rows of chlorophyllose cells); cells of chlorophyllose lamina with one or two simple papillae on the ventral surface; distal-most cells of hyaline lamina acutely exserted, from above appearing to overlap adjacent cells of the chlorophyllose lamina **Calymperes erosum**
Rib bordering lamina in distal leaf marginal; cells of chlorophyllose lamina with a single acute summit projecting from the ventral leaf surface; distal-most cells of hyaline lamina usually with flat ventral surfaces **Calymperes mangalorensis**
- 22 Gemmiferous leaves lanceolate to lingulate (when moist); blades of chlorophyllose lamina usually broader than costa, often abruptly narrowing into apical proboscis and becoming recurved below apex (Fig. 1h) 23
Gemmiferous leaves linear, bristle-like; blades of chlorophyllose lamina often narrower than costa, tapering to just below apex (usually broadening at apex) (Fig. 9i) 27
- 23 Marginal lamina bordering intramarginal rib in hyaline leaf base composed of 2–>5 rows of small, subquadrate hyaline cells; proboscis in gemmiferous leaves narrow with lamina narrowly recurved, becoming plane but not, or barely, broadening out at apex; leaves commonly more than 4 mm long **Calymperes afzelii**
Marginal lamina bordering intramarginal rib in hyaline leaf base composed of 1–2(–3) rows of small, subquadrate to shortly subrectangular hyaline cells; proboscis in gemmiferous leaves with lamina broadening somewhat around the apex; leaves rarely more than 4 mm long 24
- 24 Nongemmiferous leaves up to 2 mm long; gemmiferous leaves strongly infolded when dry, with a cowl-like apex ... **Calymperes crassinerve**
Nongemmiferous leaves usually more than 2 mm long; apex of hyaline lamina various in shape but rarely strictly truncate; gemmiferous leaves straight to curled when dry but not infolded, apices cowl-like or not 25
- 25 Costa in gemmiferous and nongemmiferous leaves thick (with an inflated appearance), lacking stereids; leaf margins unistratose throughout **Calymperes boulayi**
At least in nongemmiferous leaves costa lacking inflated appearance and incorporating stereids; leaf margins above hyaline base usually formed by a polystratose rib 26
- 26 Cells of chlorophyllose lamina 5–12(–14) µm wide, thick-walled (thick walls particularly evident around shoulders of hyaline base where the cells are polygonal but possess rounded lumina), protruding acutely from the ventral leaf surface, often with thick, pleuripapillose summits; lamina at apices of gemmiferous leaves forming a broad, oval-concave ‘collar’ **Calymperes moluccense**
Cells of chlorophyllose lamina 4–7.5 µm wide, protruding roundly to subacutely from the ventral leaf surface, not pleuripapillose or notably thickened; lamina at apices of gemmiferous leaves forming narrow, spoon-shaped ‘collar’ **Calymperes graeffeanum**
- 27 Superficial walls of cells in hyaline lamina of even thickness; in gemmiferous leaves lamina forming a narrow (often obscure) collar above the costal apex; in nongemmiferous leaves cells of chlorophyllose lamina subacutely to acutely protuberant from the ventral leaf surface (shield-shaped in cross-section); costa and margins without lamellae **Calymperes subintegrum**
Superficial walls of cells in hyaline lamina with horizontal bands of thickening; in gemmiferous leaves lamina forming a funnel-shaped leaf apex; in nongemmiferous leaves cells of chlorophyllose lamina roundly protuberant from the ventral leaf surface (fingernail-shaped in cross-section); short lamellae (1–3 cells high) often apparent on ventral surface of costa and dorsal surfaces of marginal ribs **Chameleion peguense**
- 28 Leaf margin adjacent to apex of hyaline lamina entire 29
Leaf margin adjacent to apex of hyaline lamina with teeth, spines or cilia 35
- 29 Cells forming surface of marginal rib differentiated, in cross-section subquadrate to subrectangular or rounded 30
Cells forming surface of marginal rib not differentiated, composed of stereids 31
- 30 Leaves mostly patent to recurved with apices finely drawn out; leaf margins above mid-chlorophyllose limb strongly toothed **Syrhropodon tristichus**
Leaves erect to erecto-patent with blunt apices; leaf margins entire (sometimes weakly toothed near apex) **Syrhropodon muelleri**
- 31 Leaves lingulate or elongate triangular; often with filamentous gemmae produced just above the hyaline base from lateral cells in the ventral

- surface of the costa (Fig. 22g) 32
- Leaves narrowly lanceolate or linear; gemmae not produced as described above 33
- 32 Cells of chlorophyllose lamina acutely protuberant from the ventral leaf surface, dorsally unipapillose (Fig. 22k); apex of hyaline lamina acute (Fig. 22g) **Syrrhopodon parasiticus**
- Cells of chlorophyllose lamina with compound papillae on dorsal and ventral surfaces (Fig. 24n); apex of hyaline lamina rounded-truncate (Fig. 24k) **Syrrhopodon tjibodensis**
- 33 Chlorophyllose lamina with acute, distally-pointing teeth arranged in transverse rows occurring at regular intervals (Fig. 16c, e) **Syrrhopodon albovaginatus**
- Chlorophyllose lamina lacking teeth arranged in distinct transverse rows 34
- 34 Leaf abruptly narrowing at apex of hyaline lamina, forming distinct 'shoulders' (Fig. 19c) **Syrrhopodon flammeonervis**
- Leaf gradually narrowing at apex of hyaline lamina, hardly forming 'shoulders' **Syrrhopodon prolifer** var. **albidus**
- 35 Marginal rib around mid-chlorophyllose limb with subquadrate to subrectangular or rounded superficial cells, some cells forming double or single, unicellular to multicellular teeth at regular intervals 36
- Marginal rib around mid-chlorophyllose limb with linear superficial cells, entire or with each cell forming a distally pointing tooth 38
- 36 Cells of chlorophyllose lamina protruding acutely from the ventral leaf surface, often papillose dorsally and ventrally (Fig. 20t) **Syrrhopodon gardneri**
- Cells of chlorophyllose lamina flat to slightly roundly protuberant, smooth 37
- 37 Marginal rib lacking stereids; chlorophyllose lamina hardly constricted above hyaline leaf base; leaves less than 9 mm long; shoots with well-defined stem **Syrrhopodon japonicus**
- Marginal rib incorporating stereids; chlorophyllose lamina strongly constricted for a short distance above the hyaline leaf base; leaves 6–>30 mm long; shoots acaulescent **Syrrhopodon loreus**
- 38 Surface of costa largely formed by stereids, entire (except sometimes near leaf apex) (Fig. 24h) 39
- Ventral and/or dorsal surfaces of costa composed of subquadrate to subrectangular or rounded cells (surface view), some cells often giving rise to teeth, spines or papillae (Fig. 23h, j) 40
- 39 Leaves with spinose teeth at apex **Syrrhopodon prolifer** var. **tosaensis**
- Leaves lacking spinose teeth at apex **Syrrhopodon trachyphyllus**
- 40 Superficial cells of marginal rib around mid-chlorophyllose limb each forming an acute, distally pointing tooth **Syrrhopodon hispidissimus**
- Marginal rib around mid-chlorophyllose limb entire, or only a few superficial cells forming teeth or spines 41*
- 41 Leaves abruptly narrowing from subrectangular-elliptical hyaline leaf base into a linear chlorophyllose limb; margins spinose at 'shoulders', regularly toothed in distal chlorophyllose limb, from base of chlorophyllose limb to above mid-limb entire **Syrrhopodon spiculosus**
- Leaves ligulate, slightly tapering around apex of hyaline lamina; margins often spinose or ciliate from above mid-hyaline base to beyond mid leaf, not regularly toothed towards leaf apex **Syrrhopodon armatus**

NB. Most of the genera in the family Calymperaceae that possess leucobryoid leaves are unlikely to be confused with the nonleucobryoid genera. An exception is *Exostratum* L.T. Ellis. *Exostratum blumei* and *E. sullivantii* are known to occur in the Philippines. These species have a similar aspect to *Syrrhopodon spiculosus* and *S. hispidissimus*. However, unlike the latter, the leaves in *Exostratum* have a rather stiff appearance when wet or dry, in the costa there is a complete lack of stereids and the position occupied by guide cells in *Syrrhopodon* is occupied by chlorophyllose cells.

Key 2. *Mitthyridium*

- 1 Leaves 1–3.5 mm long 2
- Leaves mostly 3.5–>5 mm long 9
- 2 Apices of leaves modified with lamina inrolled to form a cup or tube (proboscis) (Fig. 15b) 3
- Apices of leaves plane, acute to rounded 5
- 3 Leaves up to 2.5 mm long, marginal band of thick-walled linear cells less than 50 µm wide at its broadest point; lamina at leaf apex loosely inrolled to form a tube, tube often flaring distally to form a narrow funnel **Mitthyridium wallisii**
- Leaf length various; marginal band of more than 100 µm wide at broadest point; modified leaf apices cup-shaped 4
- 4 Leaves tristichous, strictly ranked; cells of lamina smooth with evenly thickened walls, lumina seldom substellate; dorsal surface of costa near apex smooth **Mitthyridium iwatsukianum**
- Leaves seldom strictly ranked; cells of lamina papillose with incrassate, unevenly thickened walls enclosing substellate lumina (Fig. 12b); dorsal surface of costa near apex with spinose teeth **Mitthyridium constrictum**
- 5 Leaves tapering from base of chlorophyllose limb towards apex 6
- Leaves with parallel sides, chlorophyllose limb not tapering until close to apex 8
- 6 Leaves mostly narrowly lanceolate with acute apices 7
- Leaves with broadly flared shoulders, tapering to an obtuse apex **Mitthyridium fasciculatum** subsp. **cardotii**
- 7 Leaves 3–3.5 mm long; hyaline lamina occupying about a seventh of the leaf length **Mitthyridium subluteum**
- Leaves seldom more than 2 mm long; hyaline lamina occupying up to about a quarter of the leaf length **Mitthyridium junquilianum**
- 8 Leaves 1.5–2 mm long; apices acute or acuminate (Fig. 12d) **Mitthyridium flavum**
- Leaves 1–1.5 mm long; apices rounded-apiculate (Fig. 14b) **Mitthyridium repens**
- 9 Apices of leaves rounded-obtuse with marginal rows of lamina cells incrassate and smooth; apex of hyaline lamina truncate **Mitthyridium fasciculatum** subsp. **obtusifolium**
- Apices of leaves acute or acuminate with marginal rows of laminal cells similar to those below; apex of hyaline lamina broadly acute 10
- 10 Leaves with broad, pronounced shoulders, tapering sharply to leaf apex; marginal band of linear, thick-walled cells usually extending from base to near apex of leaf; cells of chlorophyllose lamina (in surface view) formed by 2–4 rounded lobes, papillose with papillae easily seen in surface view **Mitthyridium fasciculatum** subsp. **fasciculatum**
- Leaves with barely defined shoulders (sometimes lacking), sides of chlorophyllose limb tapering gently towards leaf apex, or parallel and

* An apparently undescribed variety of *Syrrhopodon prolifer* Schwägr., represented by a single Philippine collection, keys out here. See under excluded taxa.

tapering abruptly near apex; marginal band of linear thick-walled cells extending from base to over two thirds the length of the chlorophyllose limb; cells of chlorophyllose lamina polygonal in surface view (not usually lobed), obscurely papillose, seen easily only in cross-section

..... *Mitthyridium papuanum*

Descriptions and illustrations of taxa

Calymperes Sw. ex F. Web., *Tab. Calyptr. operc.* (1813). Type species: *Calymperes lonchophyllum* Schwägr.

Shoots erect, simple or branched, forming mats or tufts. Leaves often dimorphic (gemmiferous and nongemmiferous), narrowly to broadly lingulate, lanceolate or linear, consisting of a hyaline, semi-sheathing base that narrows slightly, sometimes abruptly, into a chlorophyllose limb, apices various. Costa ending below apex to excurrent. Cells of chlorophyllose lamina small, mostly isodiametric, smooth, papillose, and/or protuberant. Cells of hyaline lamina large, empty, mostly smooth, with round to irregular pores in superficial and transverse walls; border between hyaline and chlorophyllose lamina usually sharply defined. Marginal and/or intramarginal ribs frequently present, usually intramarginal in hyaline base. Gemmae produced in a radial group, often from the modified apices of specialized leaves, fusiform to clavate, sometimes filamentous and branched, multicellular, uniseriate, smooth or papillose. Dioecious. Perichaetia terminal (innovations often fertile). Seta normally exerted. Capsule cylindrical with a conical operculum, enclosed in a persistent calyptra. Peristome absent.

Calymperes is most closely related to *Syrrhopodon*. The most important distinguishing feature is the presence in *Calymperes* of a persistent calyptra. It has been suggested that the calyptra in *Calymperes* plays a peristome-like role in the dispersal of spores (Edwards, 1980). In *Syrrhopodon* the calyptra is fugacious, falling from the capsule prior to spore dispersal. The differentiated leaf margin that occurs in many species in the Calymperaceae is often helpful in distinguishing between *Calymperes* and *Syrrhopodon*. In most species of *Calymperes* the hyaline lamina forming the leaf base possesses an intramarginal rib (in some species obscure or absent). In *Syrrhopodon* the hyaline lamina is often bordered by a marginal rib (in some species obscure or absent, rarely intramarginal).

Calymperes occupies a broad range across the wet regions in tropical and subtropical belts (Reese, 1987a). Species are mostly corticolous and lowland in distribution (mostly below 800 m in the Philippine archipelago). Many are confined to tree trunks along the margin of humid forests, especially in coastal areas of small islands.

There are about 24 species of *Calymperes* known from the Malesian region, of which 18 are reported here for the Philippines. A phytogeographical and floristic summary of the Philippine taxa is presented above in the introduction.

Calymperes aeruginosum Hampe ex Sande Lac. in *Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk.* 13(2): 7 (1872). Type: Philippines, Basilan Island, near Maridano, 5 January 1860, *Semper* s.n. (BM!-isotype).

Fig. 1a–f.

Calymperes mammosum Besch. in *Ann. Sci. Nat. Bot. sér. 8*, 1: 291 (1895). Type: Philippines, *Cuming* 2214 (BM!-holotype; BM!-isotype).

Shoots reaching 1–1.5 cm high, usually dark green. Leaves mostly straight and bristle-like (Fig. 1a, b) (sometimes incurled when dry), erect to patent, up to c. 6 mm long, linear with a constriction in the lamina for a short distance above the hyaline base, broadening

distally then narrowing gradually to a blunt, dentate apex. Costa strong, often occupying >25–>90 % of the width of the leaf, ending just below apex in a bluntly pointed or slightly expanded truncate tip, largely smooth, in upper leaf sometimes with a few blunt, multicellular teeth; internally with 2 layers of guide cells sandwiched between dorsal, median and ventral bands of stereids (Fig. 1f). Chlorophyllose lamina sometimes hardly apparent along constriction in leaf; cells mostly isodiametric to slightly longer than broad, with 4–6 sides or rounded, 6–12.5(–15) × 6–10(–12) µm, ventrally roundly to subacutely protuberant, dorsally flat. Hyaline lamina poorly to sharply defined. Leaf margin from around constriction in leaf to near apex plane to erect, formed by a thick polystratose rib, lacking stereids (Fig. 1f), superficial cells in surface view similar to those of the chlorophyllose lamina (slightly smaller) and some occasionally forming distant, blunt, (often multicellular) teeth; from constriction in leaf to below shoulders of leaf becoming unistratose, consisting of chlorophyllose lamina, denticulate; below shoulders of leaf to base often with an intramarginal band of long rectangular to linear, thick-walled cells, about 1–3 cells wide (Fig. 1d) (frequently obscure), laminal margin denticulate, composed of shortly subrectangular, thin-walled, hyaline cells in 1(–3) rows. Long, filamentous paraphyses produced in the axils of some leaves. Many leaves bearing gemmae on the ventral surface of the costal tip.

HABITAT. On trunks and exposed roots of trees, and on basic rock, in damp, shady lowland rainforest. The specimen cited below was growing on soil on limestone.

DISTRIBUTION. An Indo-Pacific species. Uncommon in the Philippines, but known also from Luzon and Mindanao.

SPECIMEN EXAMINED. Palawan, St Paul Bay, St Paul Subterranean National Park, 25 May 1989, *Tan* 89–1413b (FH).

Eddy (1990) notes plants of this species to be 'dark, blue-green to almost black'. However, this feature does not appear to be universal, as the recent collection cited above is green. Although yellowed by time, there is no remnant of dark colouration in the type of *Calymperes mammosum* Besch. (*Cumming* 2214, BM).

Calymperes afzelii Sw. in *Jahrb. Gewachsk.* 1: 3 (1818). Type: Africa, *Afzelius* s.n. (BM!-isotype).

Fig. 1g–m.

Calymperes vriesii Besch. in *Ann. Sci. Nat. Bot. sér. 8*, 1: 307 (1895).

Type: Sulawesi, Menahaye van Menado, *de Vriese* s.n. (Hb. Leyden, no. 4) (BM!-holotype).

Shoots reaching >3.5 cm high, in yellowish green tufts or mats. Leaves up to 5.5 mm long, dimorphic: nongemmiferous leaves lingulate; apex obtuse, broadly pointed, sometimes apiculate (Fig. 1g). Costa ending just below apex; above hyaline lamina rough with small, acute projections. Cells of chlorophyllose lamina mostly isodiametric with 4–6 sides, (3–)4–10(–12.5) × (3–)4–7.5 µm (Fig. 1k), roundly to acutely protuberant from the ventral leaf surface, sometimes with a simple papilla at the summit (Fig. 1m). Hyaline lamina sharply defined; cells in distal region often isodiametric, arranged in somewhat regular rows. Leaf margin from above hyaline base to near apex consisting of a polystratose marginal rib (usually strong), superficial cells subquadrate to shortly subrectangular, often forming small (unicellular) teeth, internally lacking stereids; in hyaline base with a narrow intramarginal band of linear, thick-walled cells (continuous with marginal rib in distal leaf), marginal lamina entire, composed of 2–>5 rows of thin-walled, subquadrate to shortly subrectangular hyaline cells (Fig. 1i). Gemmiferous

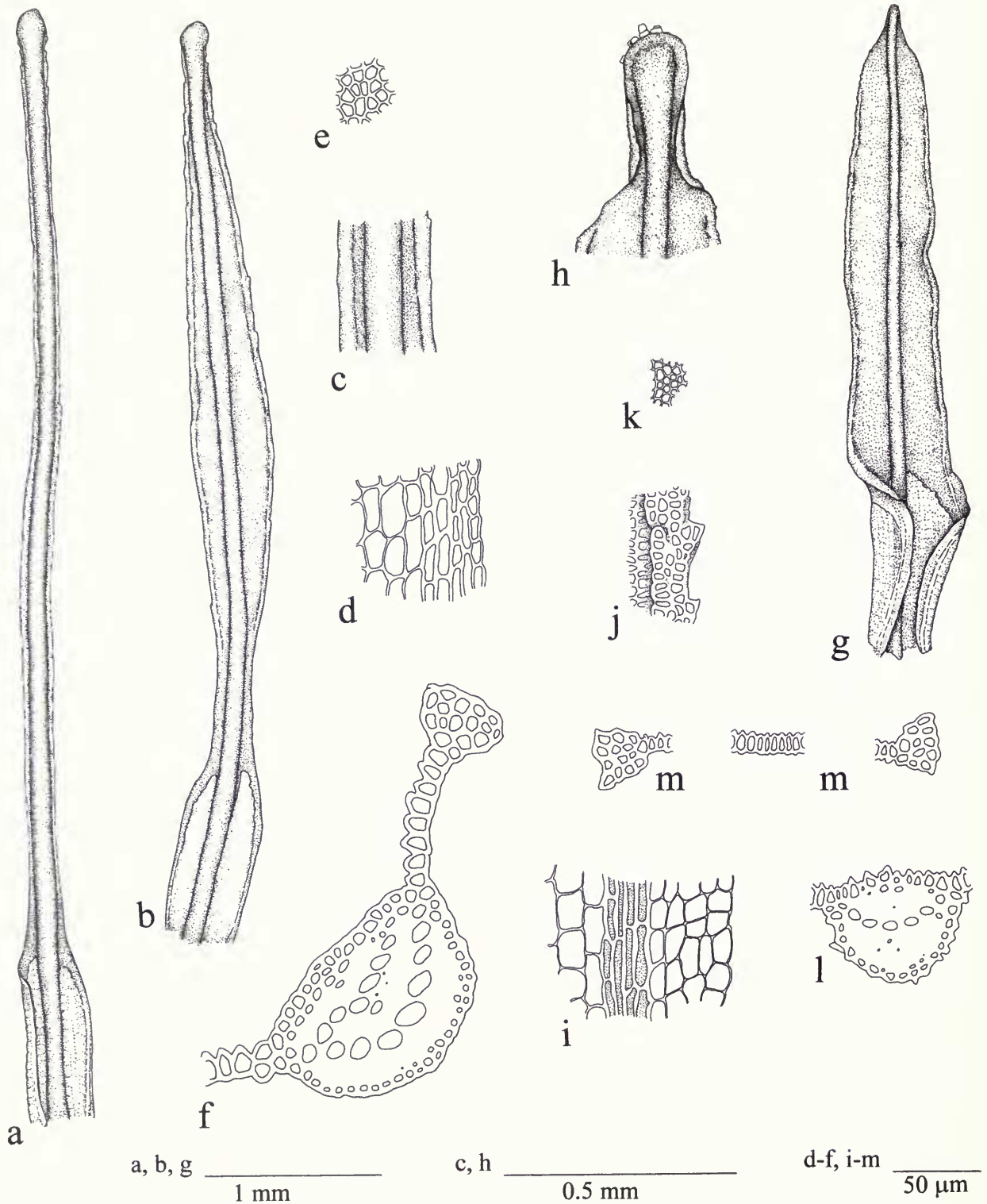


Fig. 1 a–f. *Calymperes aeruginosum* Hampe ex Sande Lac. a–c: leaves (a, b: in ventral view, with c: detail of mid-leaf; d, e: cells of leaf in surface view (d: at margin in hyaline base, e: in chlorophyllose lamina; f: cross-section of chlorophyllose limb. g–m. *Calymperes afzelii* Sw. g: leaf in ventral view; h: apex of gemmiferous leaf (dorsal view); i–k: cells of leaf in surface view (i: at margin of mid-hyaline base, j: at margin in chlorophyllose limb, k: of chlorophyllose lamina); l, m: cross-sections of leaf (l: costa, m: chlorophyllose lamina and marginal rib. a, c, d Drawn from Sarawak, *Jermy* 13734 (BM). b, e, f Drawn from *Tan* 89–1413b (FH). g–m Drawn from *Tan* 91–286 (BM).

leaves similar to above but possessing a linear apical proboscis (Fig. 1h). Costa extending into proboscis. Lamina abruptly narrowing into proboscis and becoming tightly recurved, at leaf apex becoming plane and forming a narrow, denticulate margin around the costal tip. Gemmae produced from the ventral surface of the costal apex.

HABITAT. On shaded trunks, exposed roots, decaying stumps and logs, sometimes on rock (the material cited below occurred on shale); occurring mostly in lowland areas.

DISTRIBUTION. A pantropical species. A previous report of this species from the Philippines (Menzel & Schultze-Motel, 1990) does not cite a collection or specific locality.

SPECIMENS EXAMINED. **Balabac Island**, Sitio Indalawan near Indalawan Village, 28 April 1993, *Tan* 93–228 (BM). **Palawan**, Puerto Princesa, Barangay San Rafael, Batac Village, 1 May 1991, *Tan* 91–286 (BM).

The leaves in *Calymperes afzelii* closely resemble smaller versions of those occurring in *Calymperes taitense* (Sull.) Mitt. However, the leaves of the latter always possess a narrow apical proboscis (potentially gemmiferous) and two rows of guide cells in the costa (a median layer and a smaller layer below the ventral surface). In *C. afzelii* at least some leaves have unmodified, flat apices, and there is a single (median) layer of guide cells in the costa (Fig. 11).

Calymperes boulayi Besch. in *Ann. Sci. Nat. Bot. sér. 8, 1*: 278 (1895). Type: Borneo, *Korthals* s.n. (BM!-lectotype (fide Ellis, 1988); L!, NY!-isotypes?).

Fig. 2i–n.

Calymperes dozyanum Mitt. sensu M. Fleisch., *Musc. Fl. Buitenzorg* **1**: 266 (1904).

Shoots reaching 2(–3) cm high, forming yellowish green mats or tufts. Leaves dimorphic: nongemmiferous leaves up to 3.5 mm long, lingulate to broadly lingulate (Fig. 2i), with apices obtusely pointed. Costa ending below apex, with an inflated appearance, above hyaline base rough with small, acute projections, internally virtually lacking stereids. Chlorophyllose lamina often with laxly incurved margins, cells isodiametric to slightly longer than broad, mostly irregularly quadrate to hexagonal, 5–10(–13) × (3–)5–7.5 μm, ventrally bluntly to acutely protuberant, dorsally flat, smooth or unipapillose. Hyaline lamina sharply defined. Leaf margin from around apex of hyaline lamina to leaf apex unistratose, entire or notched, rarely faintly denticulate toward leaf apex (Fig. 2l); below apex of hyaline lamina to leaf base with a narrow, unistratose intramarginal band of thick-walled linear cells (sometimes weakly developed), marginal lamina consisting of a row of thin-walled, subrectangular hyaline cells, entire to faintly denticulate (Fig. 2k). Gemmiferous leaves reaching 4 mm long, linear to broadly lingulate with an apical gemma-bearing proboscis (Fig. 2j). Costa as in nongemmiferous leaves but thicker. Lamina narrowing into proboscis, usually becoming recurved, distally becoming plane and broadening into a concave, oval collar around the costal tip. Gemmae produced from ventral surface of costal apex.

HABITAT. On trunks of trees, logs and stumps, sometimes on rock, rarely on humus at the base of trees; mostly occurring in lowland areas.

DISTRIBUTION. An Indo-Pacific species. As yet there are no records from Luzon.

SPECIMENS EXAMINED. **Mindanao**, Zamboanga, 1913, *Binstead* 142 (BM). **Palawan**, Port Barton, 30 April 1991, *Tan* 92–312 (FH).

The costa in both gemmiferous and nongemmiferous leaves of *Calymperes boulayi* has a rather inflated appearance and lacks stereids; marginal or intramarginal ribs are absent in the upper leaf, and at the apices of gemmiferous leaves a broad 'collar' of chlorophyllose lamina cups the gemmae (Fig. 2j). Together, these features distinguish this species from all others.

Calymperes erosum Müll. Hal. in *Linnaea* **21**: 182 (1848). Type: Surinam, near Paramaribo, Hb. *Kegel* 539 (PC!-isotype).

Fig. 2a–h.

Calymperes hampei Dozy & Molck., *Bryol. jav. 1*: 48 (1856). Type: Java, *Teysmann* s.n. (BM!-isotype?).

Calymperes sandeanum Besch. in *Ann. Sci. Nat. Bot. sér. 8, 1*: 303 (1895). Type: Borneo, near Pontianak, *van Oorschot* s.n. (in Hb. Lacoste) (BM!-holotype).

Shoots <1–5 cm high, in yellowish green tufts and mats. Leaves up to 5 mm long, weakly dimorphic, consisting of a suberect, subelliptical hyaline base extending into an erect to patent (when moist), narrowly lingulate to lanceolate chlorophyllose limb (Fig. 2a); distal lamina sometimes involute; leaf apex acute or apiculate, denticulate. Costa ending in apex to excurrent, above hyaline base rough with small, acute projections. Cells of chlorophyllose lamina mostly isodiametric with 4–6 sides or rounded, 5–15(–17.5) × (4–)5–8(–9) μm (Fig. 2d), drawn out ventrally into acute projections each with 1–2 simple papillae forming the summit, dorsally flat or unipapillose (sometimes bipapillose). Cells (chlorophyllose and hyaline) in rows at apex of hyaline lamina drawn out ventrally into acute, distally- or laterally-leaning projections (in surface view appearing to overlap the cells adjacent them) (Fig. 2c). Continuous, narrow intramarginal rib of thick-walled linear cells extending from leaf base to shortly below apex; in hyaline base unistratose (Fig. 2b), beyond hyaline base becoming polystratose and sometimes incorporating stereids (Fig. 2d, g). Leaf margin unistratose; beyond hyaline base gradually narrowing towards apex, denticulate, consisting of 2–5(–>8) rows of small, subquadrate, thick-walled, chlorophyllose cells; in hyaline base entire below, notched to denticulate distally; composed of 1(–3) rows of narrowly rectangular, thin-walled, hyaline cells (Fig. 2b). Gemmiferous leaves with an excurrent costa; gemmae produced from all around the costal tip.

HABITAT. On trunks, branches and exposed roots of trees, tree stumps, not infrequently on rock, sometimes on soil; mainly occurring in lowland areas.

DISTRIBUTION. A nearly pantropical species.

SPECIMENS EXAMINED. **Balabac Island**, Sitio Melville, 28 April 1993, *Tan* 93–232 (FH). **Culion Island**, Barangay Culion, 6–7 May 1992, *Tan* 92–328 (BM); *Tan* 92–381 (BM); Sitio Ugnisan, Leyson Rancho, 7 May 1992, *Tan* 92–377 (BM). **Mindoro Island**, between Bongabon and Pinamalayan, February–April 1941, *Maliwanag* 136 (BM, FH).

For a comparison of *Calymperes erosum* with *C. mangalorensis* Dixon & P. de la Varde see under account of the latter.

Calymperes fasciculatum Dozy & Molck., *Bryol. jav. 1*: 50 (1856). Type: Java, *Teysmann* s.n. (L!-holotype; BM!-isotype).

Fig. 3a–e.

Calymperes johannis-winkleri Broth. in *Mitt. Inst. Allg. Bot. Hamburg* **7**(2): 122 (1928). Type: West Borneo, Bukit Raja, 1250 m, 9 December 1924, *Winkler* 3169 (BM!-isotype).

Syrhropodon hasagawae Tak. & Iwats. in *J. Hattori Bot. Lab.* **21**: 240 (1959). Type: Japan, Kagshima Pref., Isl. Yaku, Odakumi, 14

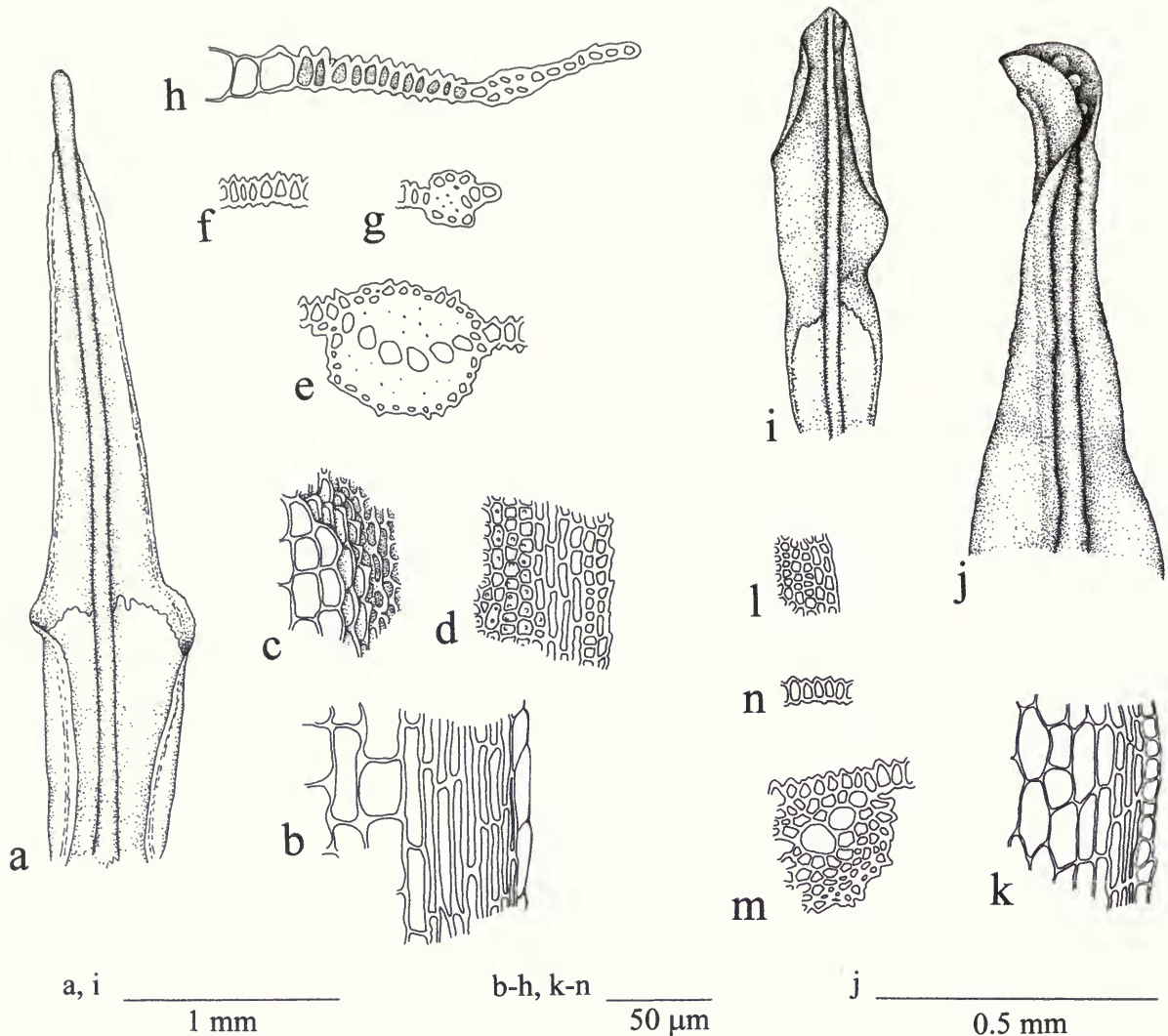


Fig. 2 a–h. *Calymperes erosum* Müll. Hal. a: leaf (ventral view); b–d: cells of leaf in surface view (b: at margin of hyaline base, c: around apex of hyaline lamina, d: in chlorophyllose lamina and at margin); e–h: cross-sections of leaf (e: costa, f: chlorophyllose lamina, g: margin in chlorophyllose limb, h: lamina and margin near apex of hyaline lamina). i–n. *Calymperes boulayi* Besch. i: nongemmiferous leaf (ventral view); j: apex of gemmiferous leaf (ventral view); k, l: cells of leaf in surface view (k: at margin of hyaline base, l: at margin of chlorophyllose limb); m, n: cross-sections of leaf (m: costa, n: chlorophyllose lamina). a–h Drawn from *Tan* 92–328 (BM). i–n Drawn from *Tan* 92–312 (FH).

April 1950, *Hasagawa, Fukuhara & Fukui* 42757 (NICH-holotype).

Calymperes hasagawae (Tak. & Iwats.) Iwats. in *J. Hattori Bot. Lab.* **28**: 220 (1965).

Calymperes johannis-winkleri var. *hasagawae* (Tak. & Iwats.) Iwats. in *J. Jap. Bot.* **43**: 476 (1968).

Shoots reaching >5 cm high, in green tufts. Leaves erect to spreading (moist), mostly 5–7.5 mm long, lanceolate to linear-lanceolate, often narrowing abruptly a short distance above hyaline lamina (forming shoulders), apex narrowly acute, denticulate (Fig. 3a). Costa ending immediately below leaf apex in a blunt, toothed tip, mostly smooth. Cells of chlorophyllose lamina thick-walled, transversely to longitudinally elongate, with 4–6 sides, often rounded-elliptical, in distal leaf (8–)10–17.5 × 10–15(–22.5) µm, smooth (Fig. 3d, e). Hyaline lamina extending from leaf base to about half way to shoulders, usually sharply defined. Leaf margins

from leaf shoulders to near apex formed by a polystratose rib, i.e. a strand of stereid/substereid cells within a superficial layer of isodiametric cells similar to those of the lamina, some forming multicellular teeth (distant below, becoming more closely set towards leaf apex) (Fig. 3c); from shoulders to distal hyaline lamina undifferentiated, entire to notched; adjacent to hyaline lamina with an intramarginal band of thick-walled, linear cells in about 7 rows, marginal lamina entire to uneven, composed of thin-walled, shortly rectangular hyaline cells in a single row (Fig. 3b). Some leaves bearing gemmae on dorsal and ventral sides of costal apex; gemmae sometimes branched, sparsely papillose.

HABITAT. On tree trunks, decaying wood and rock.

DISTRIBUTION. An Indo-Pacific species. In the Philippines known previously only from Luzon.

SPECIMEN EXAMINED. **Panay Island**, Antique, Mt Madyaas, 15–16 January 1987, *Price* s.n. (FH).

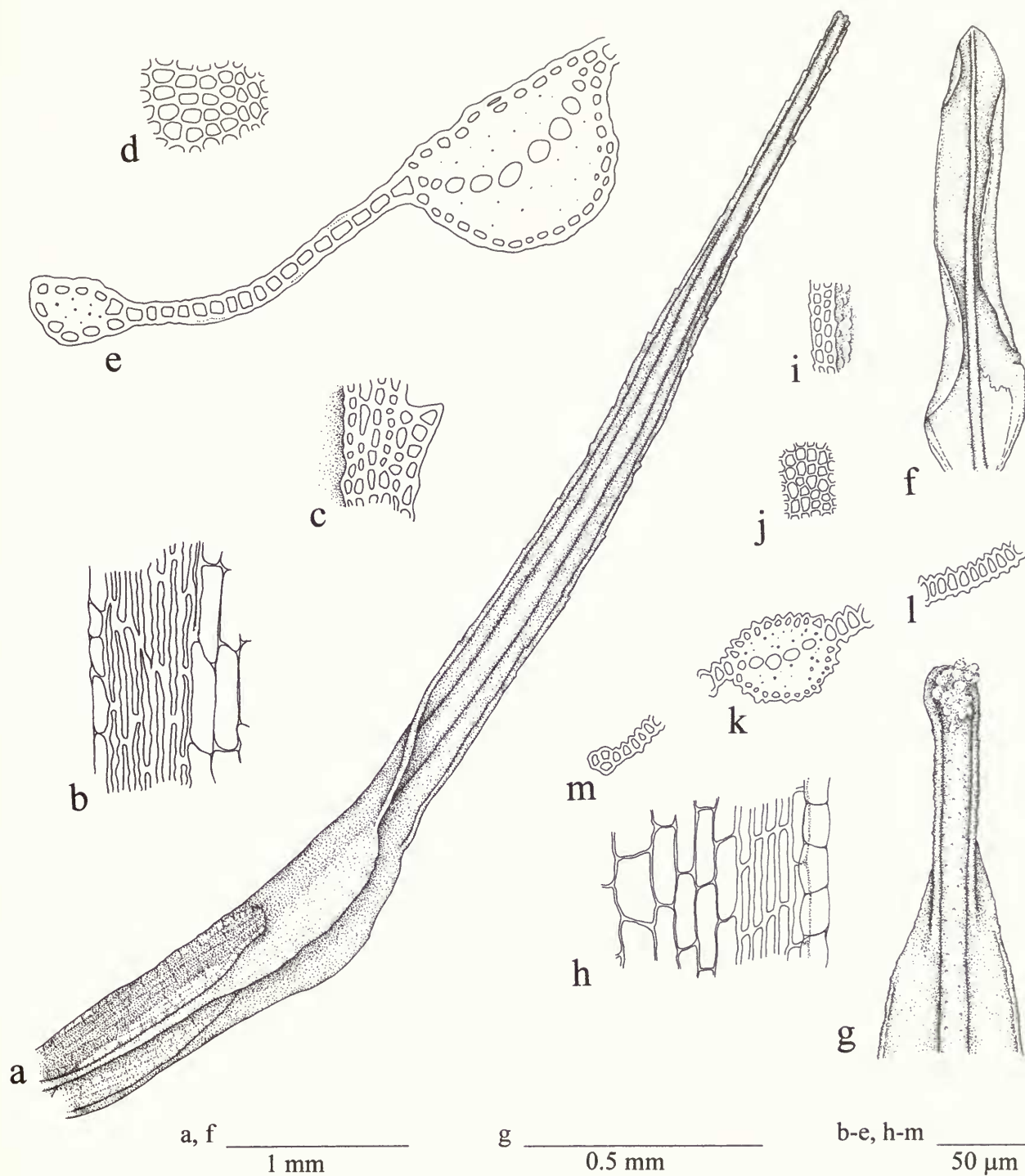


Fig. 3 a–e. *Calymperes fasciculatum* Dozy & Molke. a: leaf in ventral view; b–d: cells of leaf in surface view (b: at margin in hyaline base, c: at margin in chlorophyllose limb, d: in chlorophyllose lamina); e: cross-section of chlorophyllose limb. f–m. *Calymperes graeffeanum* Müll. Hal. f: leaf in ventral view; g: apex of gemmiferous leaf; h–j: cells of leaf in surface view (h: at margin in hyaline base, i: cells at margin in chlorophyllose limb, j: in chlorophyllose lamina); k–m: cross-sections of leaf (k: costa, l: chlorophyllose lamina, m: marginal rib). a, d, e Drawn from Price s.n. (FH). b, c, e Drawn from Sarawak, Bell 2055 (BM). f–m Drawn from Tan 93–297 (FH).

Calymperes graeffeanum Müll. Hal. in *J. Mus. Godeffroy* 3(6): 64 (1874). Type: Western Samoa, Upolu, *Graeffe* s.n. (BM!-isotype). Fig. 3f–m.

Calymperes semperi Hampe in Besch. in *Ann. Sci. nat. Bot. sér. 8*, 1: 302 (1895). Type: Philippine Islands, *Semper* s.n. (BM!-holotype; L!-isotype?).

Calymperes hyophilaceum Müll. Hal. ex Besch. in *Ann. Sci. Nat. Bot. sér. 8*, 1: 265, 287 (1895). Type: Philippine Islands, Calumpit, *Llanos* s.n. (BM?, not found; B?, destroyed 1943?).

Calymperes hyophilaceum var. *robustum* M. Fleisch., *Musc. Fl. Buitenzorg* 1: 265 (1904). Type: West Java, Rezidenz Krawang Bei Tjikao, 1899, *Fleischer (Musci Frond. Arch. Ind. no. 263)* (BM!, L!-isotypes).

Shoots reaching 1(–2) cm high, yellowish green. Leaves mostly 1.5–3.5 mm long, dimorphic: nongemiferous leaves lingulate to narrowly lingulate, leaf apex obtuse to subacute (Fig. 3f). Costa ending below apex, above hyaline base rough with small, acute projections. Chlorophyllose lamina plane, erect or laxly incurved, cells drawn out ventrally as subacute to acute projections, dorsally flat or unipapillose, mostly 5–10 × 4–7.5 µm, mostly isodiametric with 4–6 sides (Fig. 3j, l). Hyaline lamina sharply defined. Leaf margin from above apex of hyaline lamina to near leaf apex usually formed by a narrow, irregularly subdenticulate to denticulate polystratose rib (sometimes weak or absent), in surface view appearing as 2–3 rows of subquadrate chlorophyllose cells, sometimes incorporating stereids (Fig. 3i, m); adjacent to apex of hyaline lamina unistratose, entire to denticulate; from leaf base to below apex of hyaline lamina with a narrow, unistratose, intramarginal band of linear, thick-walled cells, marginal lamina unistratose, notched to denticulate, composed of 1–2 rows of shortly rectangular, thin-walled hyaline cells (Fig. 3h). Gemmiferous leaves lanceolate to narrowly lingulate with an apical gemma-bearing proboscis, apex rounded or truncate (Fig. 3g). Costa thick, often with a slightly inflated appearance, ending below apex of proboscis, internally incorporating many wide-lumened substereid cells, normal stereids few. Chlorophyllose lamina narrowing gradually to abruptly into proboscis and becoming tightly recurved, broadening distally and becoming plane to form narrow margin around the costal tip. Gemmae produced from the ventral surface of the costal tip.

HABITAT. On tree trunks and sometimes on rock, in lowland forest.

DISTRIBUTION. An Indo-Pacific species. Widespread in the Philippines.

SPECIMENS EXAMINED. **Luzon**, Mt Makiling, 27 August 1931, *Herklots* P30c (BM); Bataan Province, Lomas River, *Williams* 815 (NY); Isabela, Palanan Wilderness, 19 May 1992, *Tan* 92–207 (BM); 21 May 1992, *Tan* 92–181 (FH); **Palawan**: near Sitio Daan, Aborlan, 26 April 1992, *Tan* 92–259 (BM); St Paul Bay, St Paul Subterranean National Park, 25 May 1989, *Tan* 89–1417 (BM); Sabang Municipality, St Paul Underground River Subterranean Park, 3 May 1993, *Tan* 93–297 (FH); Iwahig, Balsahan, 4 April 1993, *Tan* 93–188 pro parte (FH); Barangay Puerto Princesa, Sitio Kalabayog, near Batac Village, 23–25 April 1993, *Tan* 93–222 (FH).

Calymperes lonchophyllum Schwägr., *Sp. musc. frond. suppl.* 1(2): 333 (1816). Type: Central America, 'Guyanne', *Richard* s.n. (PC!-isotype).

Fig. 4a–e.

Shoots reaching <1.0–>2.5 cm high, forming dense mats. Stems short to almost lacking. Leaves <9 >15 mm long, composed of a short, semi-sheathing, subelliptical hyaline base narrowing into a long-linear chlorophyllose limb (curled and contorted when dry, laxly suberect when moist); apex obtuse to acute, normally denticu-

late (Fig. 4a). Costa ending in leaf apex to shortly excurrent, smooth; internally with 1–2(–3) layers of guide cells (Fig. 4e). Chlorophyllose lamina occasionally transversely undulate, mostly unistratose, occasionally with bistratose streaks and patches, cells in surface view rounded, irregularly polygonal or quadrate to shortly subrectangular, mostly wider than long, <5–10(–12.5) × 7–15(–20) µm, thick-walled, flat, smooth or pleuripapillose (Fig. 4d, e). Hyaline lamina usually sharply defined. Leaf margin in base (adjacent to hyaline lamina) with an intramarginal rib of thick-walled, linear cells (c. 3–6 cells wide), marginal cells in 1–3(–6) rows, hyaline, thin-walled, irregular-elliptical, some in outermost row flask-shaped forming a bluntly denticulate margin (Fig. 4b); immediately above hyaline base formed by chlorophyllose lamina, unistratose, entire to denticulate; from a short distance above hyaline base to near leaf apex consisting of a robust polystratose rib, in section usually triangular, composed of small chlorophyllose cells and often incorporating a central strand of stereids; entire below; above usually with one to two rows of distant teeth (arising from angles of rib, often paired) (Fig. 4c), becoming closer set and more pronounced toward the leaf apex, each composed of a short, single row of cells ending distally as an acute projection. Long axillary hairs sometimes present, median and distal cells about 4 times longer than wide. Gemmae sometimes produced from the ventral surface of the costal apex (occasionally also from well below the apex), yellowish brown with simple papillae.

HABITAT. On tree trunks, sometimes on rock, in shaded rainforest.

DISTRIBUTION. A widespread pantropical species.

SPECIMENS EXAMINED. **Luzon**, Quezon National Park, Atimonan, 9 March 1986, *Tan & Lipaygo* s.n. (FH). **Palawan**, St Paul Bay, St Paul Subterranean National Park, 25 May 1989, *Tan* 89–1416 (BM); Puerto Princesa, Barangay Irawan, Mt Malinao, 4 May 1993, *Tan* 93–324 (FH); Barangay Apurawan, Sitio Daan, vicinity of Mt Tinik-basan, 27 April 1992, *Tan* 92–266 (BM).

Calymperes serratum A. Braun ex Müll. Hal. and *C. lonchophyllum* are superficially very similar but may be separated by two key features. Firstly, in *C. lonchophyllum* the hyaline lamina (in most leaves) is very sharply defined, with the relatively large, thin-walled, empty cells at its apex abutting the small, thick-walled, green cells forming the base of the chlorophyllose lamina. In *C. serratum* the distal cells of the hyaline lamina intergrade gradually with those of the chlorophyllose lamina. The second key distinguishing feature was recognized by Akiyama & Reese (1993) and Reese & Stone (1995). Long axillary hairs occur in both species (particularly commonly in *C. serratum*). In *C. lonchophyllum* the median and distal cells of these hairs are about four times as long as broad; those in *C. serratum* are seldom more than twice as long as broad. Additionally, the chlorophyllose lamina in *C. serratum* is consistently smooth and unistratose, and the intramarginal rib in the hyaline leaf base is often weak to the point of absence. In *C. lonchophyllum* the chlorophyllose lamina is often papillose with bistratose patches, and the intramarginal rib in the hyaline leaf base is well-developed.

Calymperes mangalorese Dixon & P. de laVarde in *Arch. Bot. (Paris)* 1(8–9): 164 (1927). Type: Southern India, Mangalore, Kananady, November 1925, *Foreau* 22 (BM!-holotype; PC!-isotype).

Fig. 4f–k.

Shoots reaching 2 cm high, forming yellowish green tufts or mats. Leaves up to 3.5(–4) mm long, hardly dimorphic; narrowly to broadly lingulate, distal chlorophyllose lamina sometimes involute; leaf apex acute to obtuse, occasionally apiculate (Fig. 4f). Costa ending in apex to shortly excurrent, above hyaline base usually

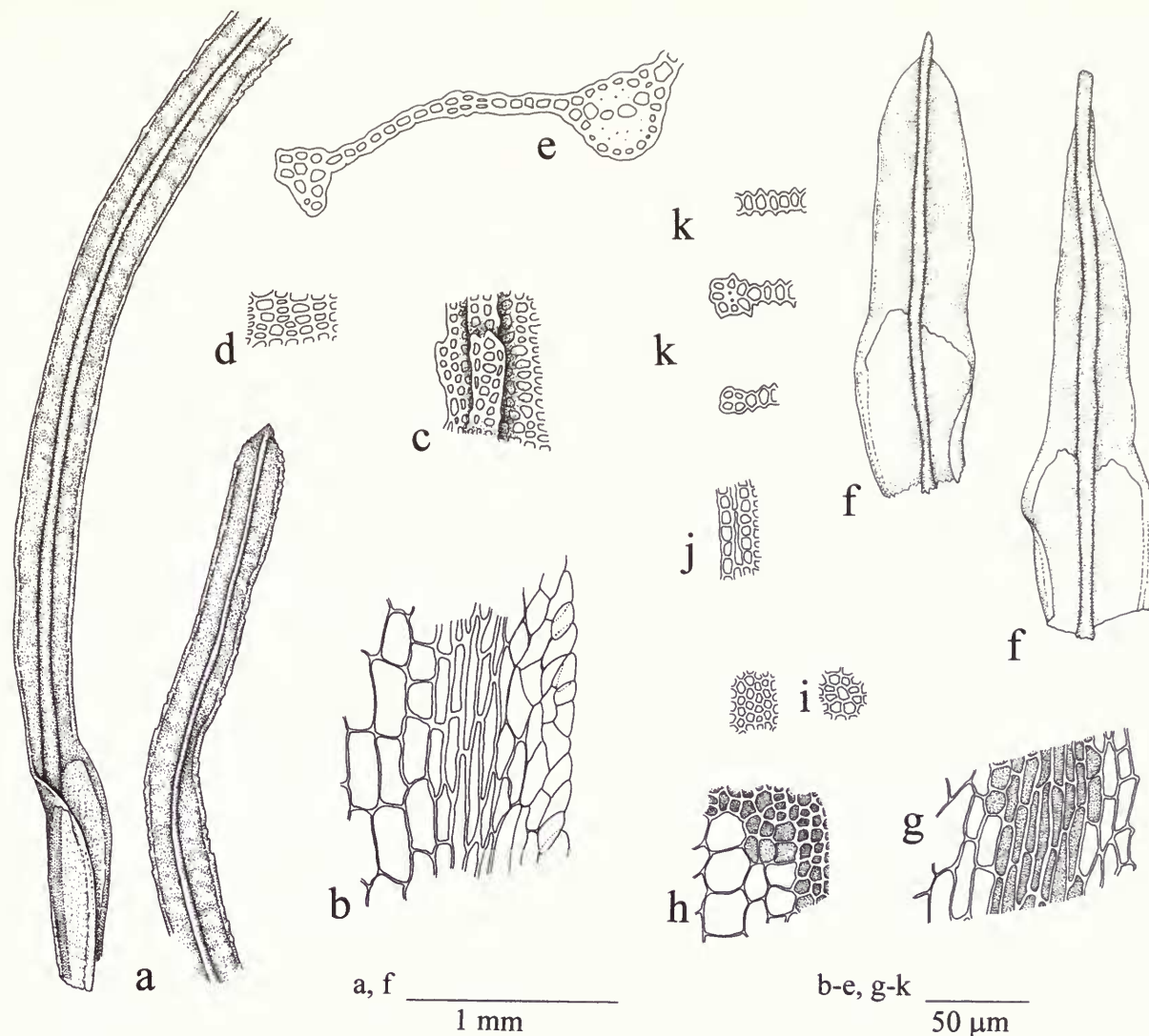


Fig. 4 a–e. *Calymperes lonchophyllum* Schwagr. a: leaf; b–d: cells of leaf in surface view (b: at margin in distal hyaline base, c: in marginal rib in chlorophyllose limb, d: in chlorophyllose lamina); e: cross-section of chlorophyllose limb. f–k. *Calymperes mangalorese* Dixon & P. de la Varde f: leaves; g–j: cells of leaf in surface view (g: at margin of distal hyaline base, h: around apex of hyaline lamina, i: in chlorophyllose lamina, j: at margin in chlorophyllose limb); k: cross-section of chlorophyllose lamina and marginal rib. a–e Drawn from *Tan* 89–1416 (BM). f–k Drawn from *Tan* s.n. (FH).

rough with small, acute projections. Cells of chlorophyllose lamina subsodiametric with 4–7 sides, $<5-11(-12.5) \times 5-10 \mu\text{m}$ (Fig. 4i), drawn out ventrally into rounded to acute projections, dorsally flat to unipapillose (Fig. 4k). Hyaline lamina sharply defined. Leaf margin beyond apex of hyaline lamina to near leaf apex, entire to uneven, formed by a polystratose rib of subquadrate to shortly subrectangular chlorophyllose cells (steroids sometimes present) (Fig. 4j, k), sometimes becoming intramarginal around apex of hyaline lamina; from around distal hyaline lamina to leaf base with an intramarginal unistratose band of long rectangular to linear thick-walled cells (often continuous with marginal rib in upper leaf, sometimes poorly developed), marginal lamina composed of 1–3 rows of thin-walled, subrectangular hyaline cells, entire to denticulate (Fig. 4g). Gemmiferous leaves with excurrent costa, gemmae produced from all around the costal tip.

HABITAT. The specimen cited below occurred on the bark of a tree in an open karst forest.

DISTRIBUTION. Formerly known only from India and Burma.

SPECIMEN EXAMINED. **Coron Reef Island** (Palawan Province), Coron Town, Lake Kayangan, off coast of Coron Municipality of Basuanga Island, 8 May 1992, *Tan* s.n. (FH) (new record).

This species has been confused with *Calymperes erosum*. In the leaves of the latter there is an intramarginal rib in the limb; the distal rows of cells in the hyaline lamina protrude acutely from the ventral surface of the leaf, overlapping the cells immediately distal to them; and (in most specimens) at least a few of the ventrally protuberant cells forming the chlorophyllose lamina have bipapillose summits. The leaves of *C. mangalorese* have a marginal rib in the limb (Fig. 4k), lack protuberant hyaline cells (Fig. 4h), and the ventrally protuberant cells forming the chlorophyllose lamina all possess unipapillose summits.

Calymperes mangalorese closely resembles *Calymperes graefeanum* in all features apart from the possession of leaves with an excurrent costa.

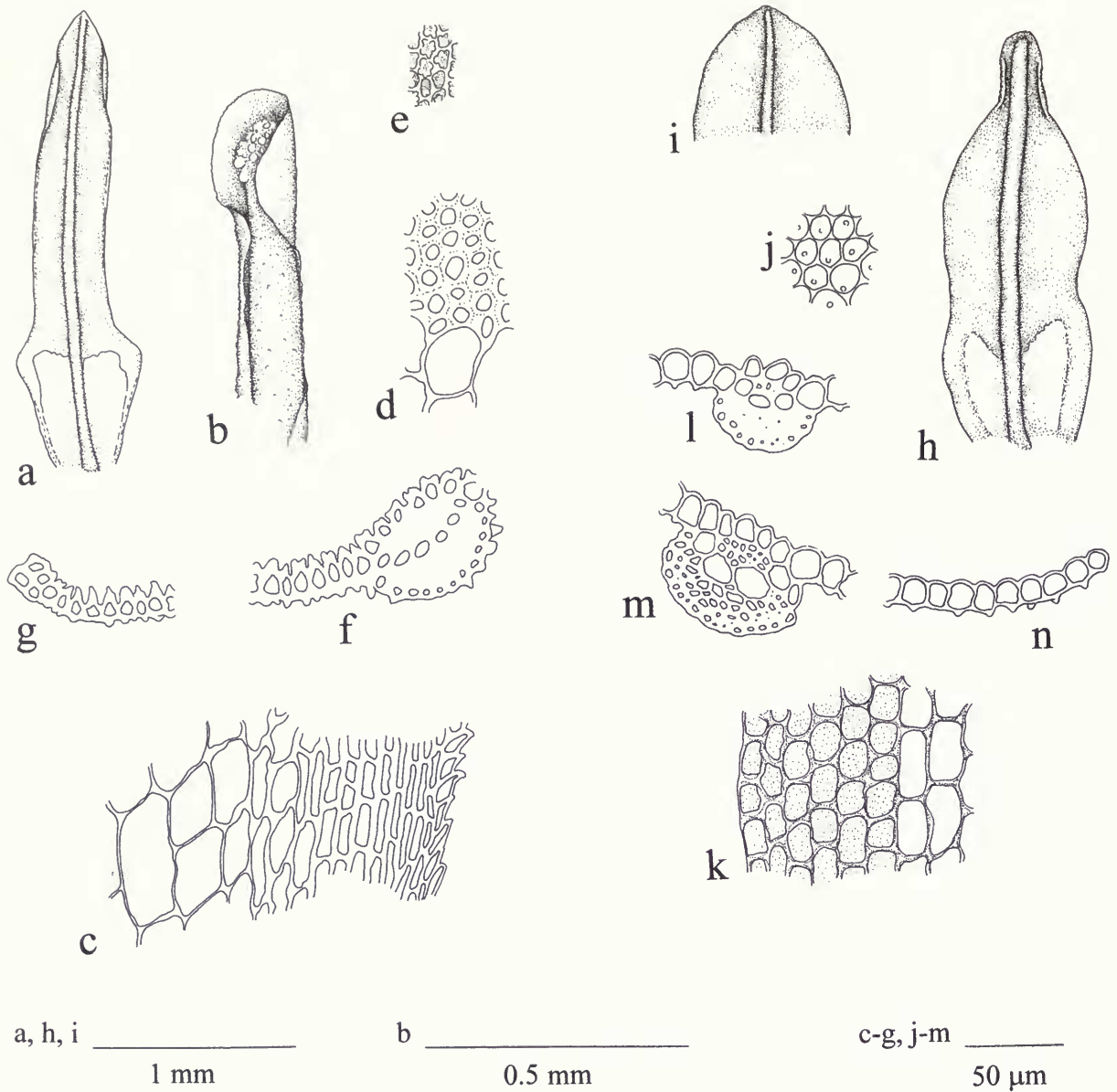


Fig. 5 a–g. *Calymperes moluccense* Schwägr. a: nongemiferous leaf (ventral view); b: apex of gemmiferous leaf (ventral view); c–e: cells of leaf in surface view (c: at margin of hyaline base, d: around apex of hyaline lamina, e: in chlorophyllose lamina); f, g: cross-sections of leaf (f: costa and chlorophyllose lamina, g: marginal rib and chlorophyllose lamina). h–n. *Calymperes motleyi* Mitt. ex Dozy & Molk. h: gemmiferous leaf (dorsal view); i: apex of nongemiferous leaf; j, k: cells of leaf in surface view in (j: chlorophyllose lamina, k: margin of hyaline base); l–n: cross-sections of leaves (l: costa (nongemmiferous), m: costa (gemmiferous), n: chlorophyllose lamina). a–g Drawn from *Tan* 92–186 (FH). h–n Drawn from *Tan* 93–240 (FH).

Calymperes moluccense Schwägr. *Sp. musc. frond. suppl.* 2(1): 99 (1824). Type: Moluccas, Rawak, *Gaudichaud* 29 (15) (BM!-isotypes).

Fig. 5a–g.

Calymperes palisotii subsp. *moluccense* (Schwägr.) M. Menzel in M. Menzel & Schultze-Motel in *Willdenowia* 19: 489 (1990).

Shoots reaching 2(–3) cm high, green above, often dark brown below, forming tufts or mats. Leaves 2.5–3.5 mm long, dimorphic: nongemmiferous leaves consisting of a narrowly lingulate chlorophyllose limb, extending (spreading when moist) from the slightly flared shoulders of a suberect hyaline base, distal

chlorophyllose lamina often involute, leaf apex obtuse, sometimes apiculate (Fig. 5a). Costa ending below apex, above hyaline base rough with coronate-papillose projections. Cells of chlorophyllose lamina drawn out ventrally into acute, often coronate-papillose projections, dorsally smooth or unipapillose (Fig. 5f, g), thick-walled (especially in region adjacent to hyaline lamina (Fig. 5d)), mostly 5–13 × 5–12 µm, isodiametric with 4–6 sides or rounded. Hyaline lamina sharply defined, often differentiated: cells in rows nearer the margin narrow with unevenly thickened walls (Fig. 5c), in rows adjacent to the costa broad and evenly thin-walled. Leaf margin from above shoulders to near apex formed by a narrow, irregularly subdenticulate, polystratose rib, in surface view appearing as 2–3

rows of subquadrate chlorophyllose cells, rarely incorporating stereids; at shoulders unistratose and denticulate, formed by small, thick-walled chlorophyllose cells; below shoulders with an intramarginal band of linear, thick-walled cells (sometimes continuous with marginal rib of upper leaf), marginal lamina unistratose, entire to denticulate, formed by 1–2 rows of subrectangular, thin-walled, hyaline cells (Fig. 5c). Gemmiferous leaves narrowly lingulate to lanceolate with an apical, gemma-bearing proboscis (Fig. 5b). Costa stout. Lamina abruptly narrowed into proboscis and becoming tightly recurved; at apex, broadening and becoming plane to form a collar around the costal tip. Gemmae produced from ventral surface of costal tip.

HABITAT. On the trunks and branches of trees, stumps and logs, sometimes on rock; occurring in lowland areas.

DISTRIBUTION. Widespread in the Indo-Pacific. In the Philippines, in addition to the localities cited below, also known from Bohol and Mindanao.

SPECIMENS EXAMINED. **Culion Island** (Palawan Province), near Sitio Ugnisan, 7 May 1992, *Tan* 92–382 (BM). **Luzon**, Isabela Province, Palanan Wilderness, 20 May 1992, *Tan* 92–212 (FH); 21 May 1992, *Tan* 92–186 (FH); Bicobian Bay, 22 May 1992, *Tan* 92–177 (FH). **Palawan** (Palawan Province), Barangay Napsan, Sitio Tagkulit, Salakot Waterfall vicinity, 2 May 1993, *Tan* 93–265 (FH).

Calymperes palisotii Schwägr. has been regarded by some authorities as a variety of *C. moluccense*. However, *C. palisotii* appears to be as distinct a species as any other in the genus (Ellis, 1987) and occurs mainly in the New World tropics, Africa and western SE Asia; it is extremely rare in Malesia and absent from Oceania. *Calymperes moluccense* has an Indo-Pacific distribution. In *C. moluccense* the leaves often have flared 'shoulders' where the hyaline lamina broadens before abruptly narrowing into the chlorophyllose limb; at the apices of gemmiferous leaves the chlorophyllose lamina forms a broad 'collar' around the gemmae (Fig. 5b); most cells in the chlorophyllose lamina and superficial cells in the costa protrude acutely and are often multipapillose on the protruding surface (Fig. 5f, g), those laminal cells adjacent to the distal hyaline lamina are usually strongly incrassate with a visible middle lamella (Fig. 5d); the cells of the hyaline lamina forming the rows adjacent to the intramarginal rib are often differentiated from those nearer the costa, being strikingly narrower with walls more unevenly thickened. In *C. palisotii* the leaves usually possess less pronounced shoulders (sometimes not evident); the lamina at the apices of gemmiferous leaves forms a narrow band around the costal apex; the cells of the chlorophyllose lamina and the superficial cells in the costa are roundly protuberant and lack papillae on the protruding surface, those laminal cells adjacent to the distal hyaline lamina are not unusually thick-walled; and the cells of the hyaline lamina are evenly thin-walled and not differentiated, with a gradual decrease in cell size across the lamina from the costa to the intramarginal rib.

Calymperes motleyi Mitt. ex Dozy & Molk., *Bryol. jav.* 1: 48 (1856). Type: Borneo, Labuan Island, Tanjong, *Motley* s.n. (BM!-isotype).

Fig. 5h–n.

Shoots reaching 1.5 cm high, forming yellowish green tufts or mats. Leaves about 2 mm long (erect to patent when moist), dimorphic: nongemmiferous leaves obovate to lingulate, distal chlorophyllose lamina sometimes involute, leaf apex obtuse to obtuse-apiculate. Costa ending below apex; in distal leaf ventral superficial cells protruding roundly, some dorsal superficial cells drawn out as blunt

projections; internally incorporating some substereid cells. Cells of chlorophyllose lamina collenchymatous, rounded to subhexagonal, 8–20 × 7.5–15 μm (Fig. 5j), protruding roundly from the ventral leaf surface, dorsally flat to slightly convex and/or unipapillose (Fig. 5n). Hyaline lamina sharply defined and enclosed on either side by broad marginal bands of small quadrate to shortly rectangular cells with differentially thickened transverse walls and/or angles (Fig. 5k). Leaf margins unistratose, entire, slightly irregular. Gemmiferous leaves lingulate with an apical, gemma-bearing, shortly suboblong proboscis (Fig. 5h). Costa often thicker than in nongemmiferous leaves, often incorporating substereid cells, extending into proboscis. Lamina abruptly narrowing into proboscis and becoming recurved, distally becoming plane to form a narrow, rounded margin around the costal tip. Gemmae arising from the ventral surface of the costal apex.

HABITAT. On trees in lowland areas. The specimen cited below occurred in an open, windy mangrove forest of *Avicenna*.

DISTRIBUTION. A widespread Indo-Pacific species.

SPECIMEN EXAMINED. **Balabac Island** (Palawan Province), Sitio Melville, 28 April 1993, *Tan* 93–240 (FH) (new record).

Calymperes motleyi and *C. tenerum* Müll. Hal. are similar in size, possess leaves with almost identical hyaline bases, and have sometimes been confused with each other. Under the microscope they are immediately distinguishable. In *C. motleyi*, the large (8–20 × 7.5–15 μm), unipapillose, collenchymatous cells that form the chlorophyllose lamina (Fig. 5j) contrast strongly with the small (7–12.5 × 7–10(–12.5) μm) polygonal cells of the chlorophyllose lamina in *C. tenerum* (Fig. 10o). Apart from the key features, these species are also distinguishable by the attitude of the leaves on the stem when dry. The apices in *C. motleyi* tend to roll inwards; in *C. tenerum* the leaves when dry often twist spirally around the shoot, or curl variously.

Calymperes porrectum Mitt. in *J. Linn. Soc. Bot.* 10: 172 (1868).

Type: Samoa, Tutuila, *Powell* 10 (BM!-isotype).

Fig. 6.

Calymperes salakense Besch. in *Ann. Sci. Nat. Bot. sér.* 8, 1: 271, 302 (1895). Type: Java, Mont Salak, near Buitenzorg, 400 m, *Kurz* 154 (BM!-holotype).

Calymperes scalare Besch. in *Ann. Sci. Nat. Bot. sér.* 8, 1: 303 (1895). Type: Philippines, Basilan Island, *Semper* s.n. (BM!-holotype).

Shoots robust, reaching >6 cm high, in yellowish green tufts or mats. Leaves mostly 5–7 mm long, strongly dimorphic: nongemmiferous leaves consisting of a recurved (moist or dry), narrowly to broadly lanceolate limb extending from the (usually distinct) shoulders of a suberect hyaline base; leaf apex narrowly to broadly acute (Fig. 6b). Costa ending immediately below apex to shortly excurrent, above hyaline base superficial cells smooth or drawn out into small, acute projections. Cells of chlorophyllose lamina mostly isodiametric, subquadrate to rounded, <5–10(–12.5) × <5–10(–12.5) μm, smooth, flat or ventrally slightly protuberant (Fig. 6h, j). Hyaline lamina sharply defined. Leaf margin with an intramarginal rib extending from leaf base to near apex; from shortly above apex of hyaline lamina polystratose, a strand of stereid-like cells with superficial cells similar to those of the lamina (Fig. 6k); from above apex of hyaline lamina to leaf base becoming a band of linear, thick-walled cells in 4–5 rows. Marginal lamina unistratose, narrowing from shortly below apex of hyaline base towards leaf apex, from about midleaf apparent only as a series of single, large, multicellular teeth; below midleaf to mid-hyaline lamina uneven to dentate, composed of several rows of cells similar to those of the chlorophyllose lamina

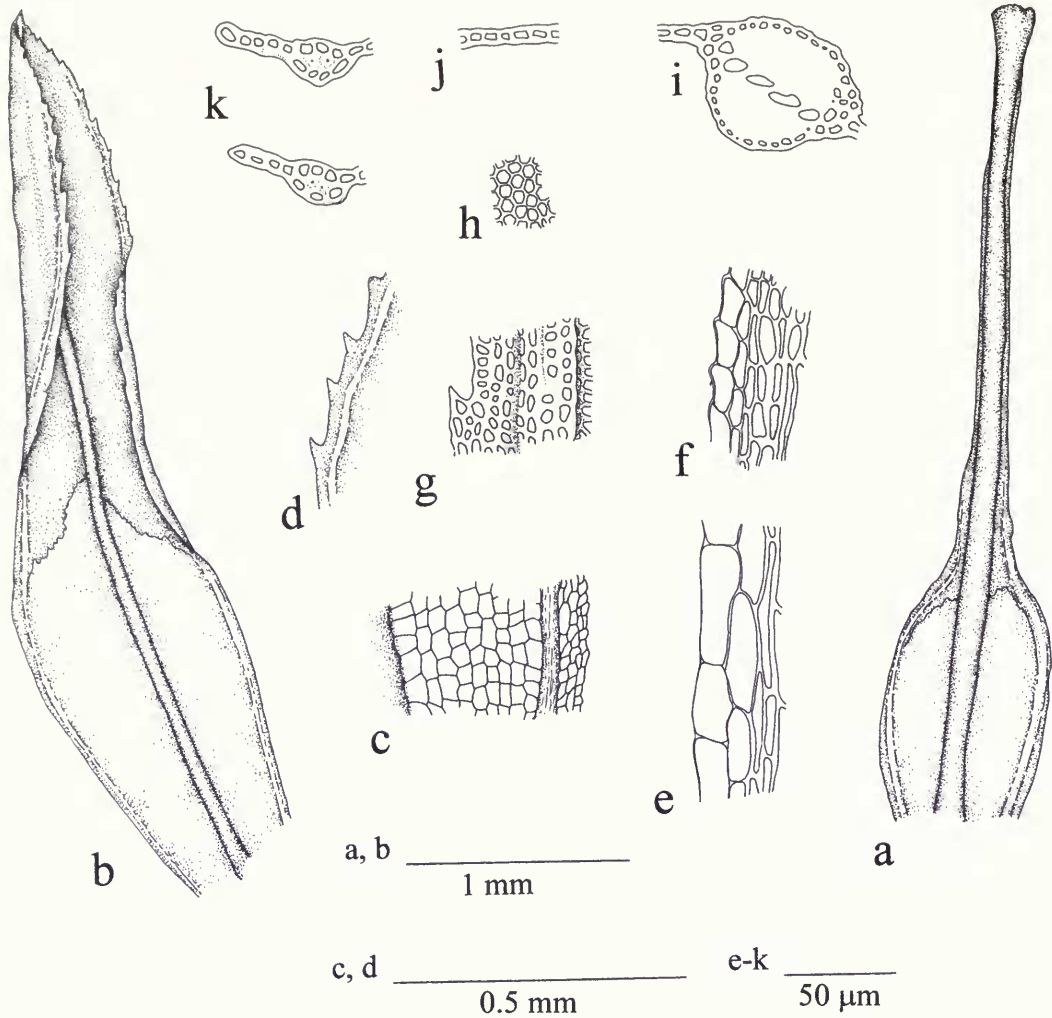


Fig. 6 a–k. *Calymperes porrectum* Mitt. a, b: leaves (a: gemmiferous leaf, b: nongemmiferous leaf); c, d: details of leaf (c: proximal hyaline base, and d: margin of chlorophyllose limb); e–h: cells of leaf in surface view (e: at margin in proximal hyaline base, f: at margin in distal hyaline base, g: at margin in chlorophyllose limb, h: in chlorophyllose lamina); i–k: cross-sections of leaf (i: costa, j: chlorophyllose lamina, k: margin in chlorophyllose limb. a–d Drawn from *Semper* s.n. (BM). e, f Drawn from North Borneo, *Wood* 1625 (BM). g–k Drawn from Papua New Guinea, *Cheesman* s.n. (BM).

(Fig. 6g); from around mid-hyaline lamina to leaf base entire to denticulate, consisting of 1–3 rows of shortly rectangular to slightly irregular thin-walled hyaline cells (Fig. 6e). Gemmiferous leaves suberect, a linear chlorophyllose limb abruptly narrowing from a subelliptical hyaline base (Fig. 6a); leaf apex rounded to truncate, denticulate. Costa thick, occupying more than two thirds of the width of the chlorophyllose limb for most of its length, shortly excurrent and broadening slightly at apex; beyond hyaline base rough with subacute to acute projections. Chlorophyllose lamina narrowing gradually from above hyaline base to just short of leaf apex. Gemmae produced from all around costal tip.

HABITAT. On tree trunks, rarely on soil, in moist, shaded forest; occurring from near sea level to around 900 m.

DISTRIBUTION. An Indo-Pacific species.

No local collections examined, apart from the type of *Calymperes scalare* Besch.

Calymperes robinsonii B.C. Tan & W.D. Reese in W.D. Reese & B.C. Tan in *Bull. Natl. Sci. Mus., Tokyo, Series B*, **9**: 30 (1983).
Type: Philippines, Palawan Island, Mt Apis, *Ebalo & Conklin* 82803 (PNH-holotype).

Fig. 7.

Shoots acaulescent. Leaves <9–>17 mm long, composed of a short, semi-sheathing, subelliptical hyaline base with a long-linear chlorophyllose limb (stiffly suberect when moist) (Fig. 7a); leaf blade immediately above hyaline base narrowing abruptly into costa, absent distally for a short distance (1–<2 mm) then re-emerging gradually into the chlorophyllose limb (i.e. forming a petiole) (Fig. 7c); apex subacute to obtuse, denticulate. Costa usually ending in apex, smooth; internally mostly with 2–4 layers of guide cells (costa in region of petiole especially thick and with guide cells in several layers) (Fig. 7f). Chlorophyllose lamina sometimes undulate, mostly unistratose, sometimes with small bistratose patches, cells in surface view rounded, irregularly polygonal or

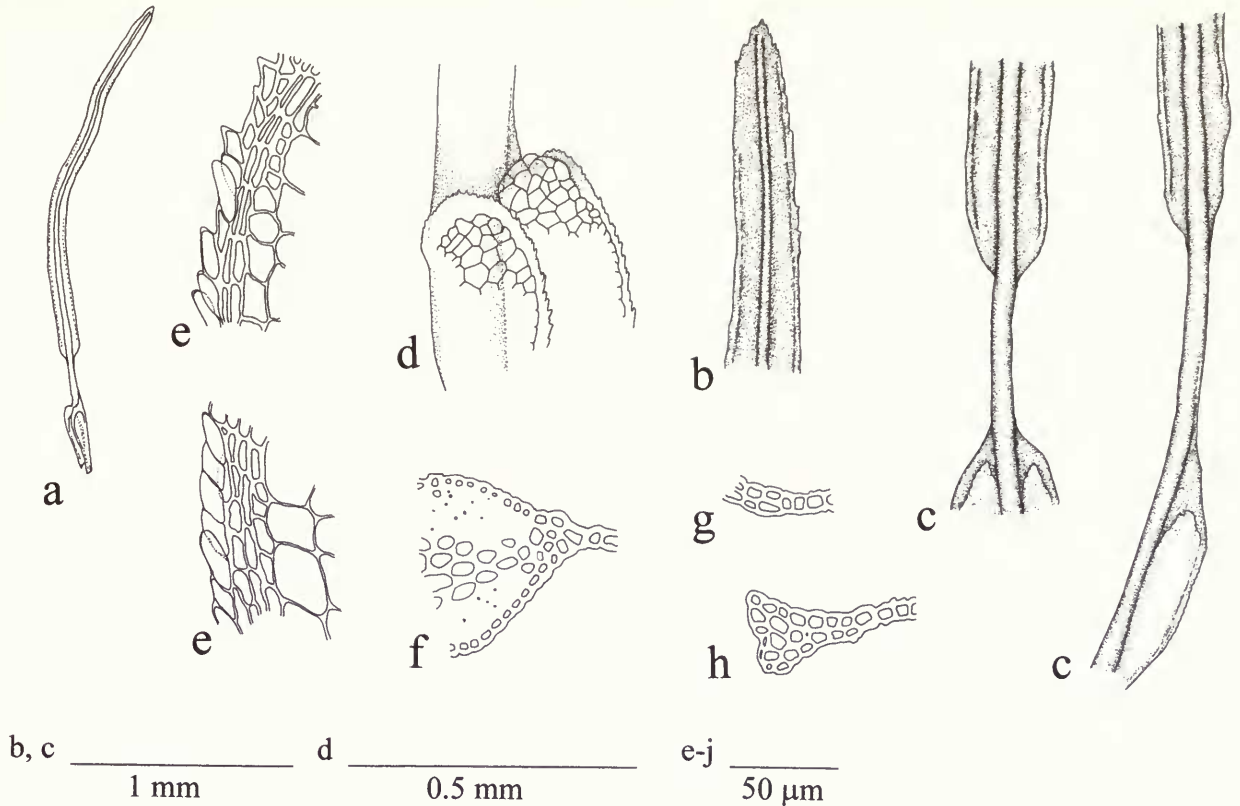


Fig. 7 a–h. *Calymperes robinsonii* B.C. Tan & W.D. Reese a–d: leaf (a: semidiagram and details of b: apex, c: ‘petiolate’ region above hyaline base, d: distal hyaline base; e: cells at margin in leaf base; f–h: cross-sections of leaf (f: costa in distal chlorophyllose limb, g: chlorophyllose lamina, h: marginal rib in chlorophyllose limb). b, c Drawn from *Tan* 89–1426 (BM). d, f, g, h Drawn from *Tan* 93–224 (FH). e Drawn from *Tan* 89–1422 (BM).

quadrate to shortly subrectangular, mostly wider than long, $<5\text{--}10 \times <5\text{--}12.5\ \mu\text{m}$, thick-walled, flat, smooth to obscurely pleuripapillose. Hyaline lamina sharply defined, often bulging ventrally at distal extremity. Leaf margin from insertion to beyond mid-hyaline base similar to that in *C. lonchophyllum* with an intramarginal rib of thick-walled linear cells within a narrow marginal band of thin-walled hyaline cells (Fig. 7e); from distal hyaline base to petiole formed by a narrow band of chlorophyllose lamina, unistratose, denticulate; in petiole entire; from above petiole to near leaf apex consisting of a polystratose rib largely composed of small chlorophyllose cells, in cross-section triangular, lacking a central strand of stereids, distant multicellular teeth arising from angles of rib, (Fig. 7h). Groups of long, filamentous axillary hairs produced in some leaves. Gemmae sometimes produced from the leaf apex.

HABITAT. On shaded tree trunks and occasionally on limestone outcrops.

DISTRIBUTION. A western Malesian species.

SPECIMENS EXAMINED. Luzon, Mt Arayat, 1896, *Loher* 1057 (BM). Palawan, St Paul Bay, St Paul Subterranean National Park, 25 May 1989, *Tan* 89–1422 (BM); *Tan* 1426 (BM); Barangay Puerto Princesa, Sitio Kalabayog, near the Batac Village, ‘23, 25’ April 1993, *Tan* 93–224 (FH).

The abrupt and complete disappearance of the lamina just above the hyaline base and its equally abrupt reappearance shortly above will distinguish leaves of this species from those of any other of the long-leaved species of Calymperaceae occurring in the Philippines. A less extreme constriction of the lamina occurs in the leaves of

Syrhropodon loreus (Sande Lac.) W.D. Reese. However, in this species, the margins of the distal hyaline leaf base are replete with acute, thick-walled teeth (Fig. 21t), and the costa possesses a single layer of guide cells (Fig. 21u). In *C. robinsonii* the hyaline base has an intramarginal rib, with a margin incorporating thin-walled hyaline cells (Fig. 7e); the costa includes 2–4 layers of guide cells (Fig. 7f).

Calymperes aeruginosum also possesses linear leaves with a constricted lamina. This species has short leaves (c. 6 mm long) as compared to those in *C. robinsonii* (mostly 9–17 mm long). In the latter, the cells of the chlorophyllose lamina are flat ventrally, those of *C. aeruginosum* are ventrally protuberant.

Calymperes serratum A. Braun ex Müll. Hal., *Syn. musc. frond.* 1: 527 (1849). Type: Java, *Junghuhn* s.n. (BM!, L!-isotypes). Fig. 8.

Shoots reaching > 2 cm high, in dense green mats or tufts; stems very short, barely apparent. Leaves 10–20 mm long, linear, laxly erect to suberect (moist), with a subelliptical hyaline base; above hyaline base narrowing for a short distance then broadening slightly and gradually towards mid leaf; near apex narrowing to form an acute, dentate tip (Fig. 8a–d). Costa ending in apex to shortly excurrent, smooth; internally with 2(–3) layers of guide cells. Chlorophyllose lamina sometimes transversely undulate, cells transversely to longitudinally elongate, rounded-elliptical or with 4–6 sides, $5\text{--}10\text{--}(12.5) \times 8\text{--}12.5\ \mu\text{m}$, smooth, flat to slightly protuberant (Fig. 8g, h, k). Hyaline lamina poorly defined, distal hyaline cells merging gradually

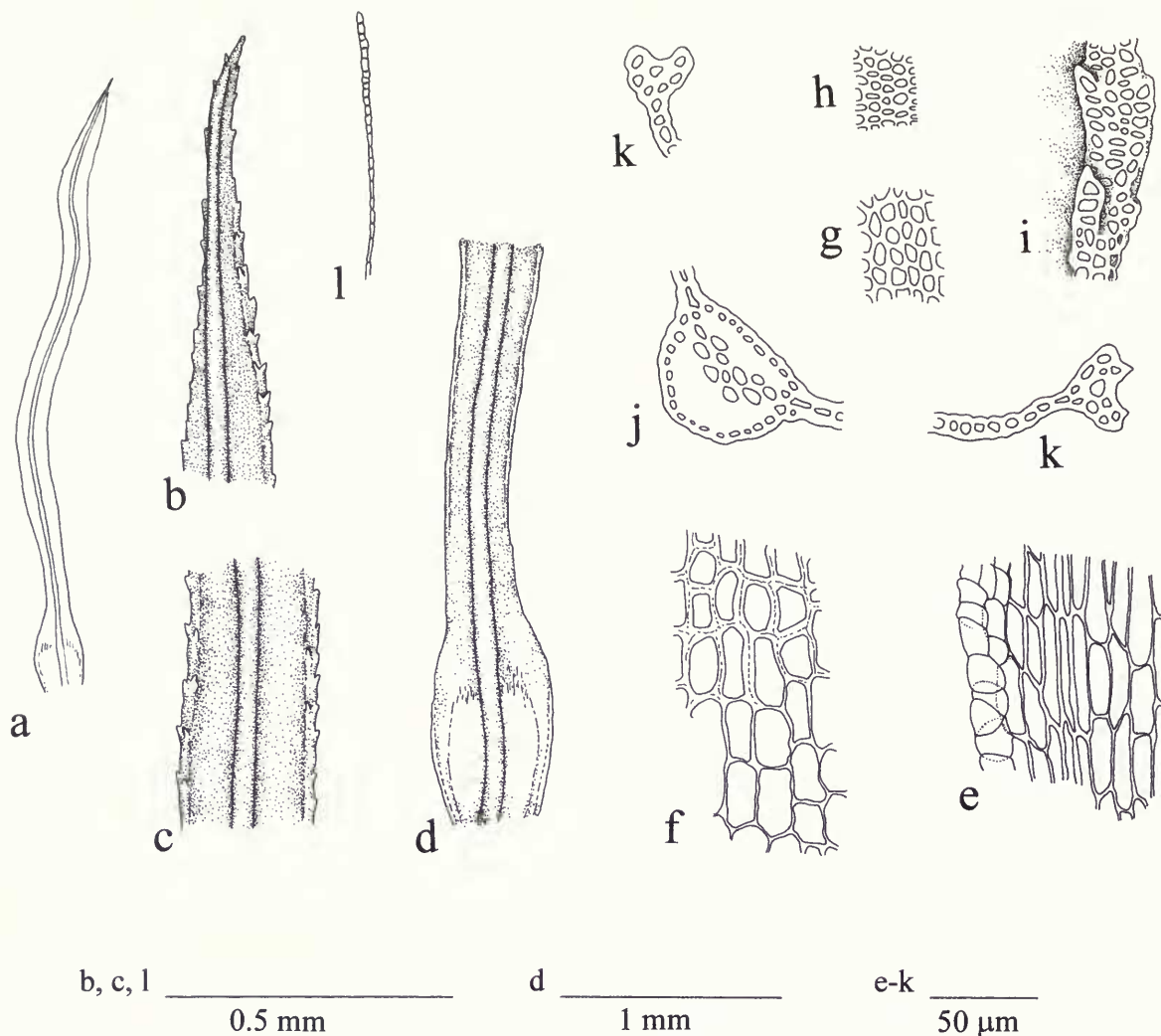


Fig. 8 a–k. *Calymperes serratum* A. Braun ex Müll. Hal. a–d: leaf (a: semidiagram (ventral view), and details of b: apex, c: mid-leaf, d: lower leaf); e–i: cells of leaf in surface view (e: at margin of distal hyaline base, f: around apex of hyaline base, g: in proximal chlorophyllose lamina, h: in distal chlorophyllose lamina, i: at margin of chlorophyllose limb); j, k: cross-sections of leaf (j: costa, k: chlorophyllose lamina and marginal rib); l: axillary hair. b–i Drawn from *Herklots* P14 (BM). j–l Drawn from *Elmer* 10387 (BM).

into chlorophyllose lamina above (Fig. 8f). Leaf margin a short distance beyond hyaline base formed by a polystratose rib, internally sometimes incorporating a strand of stereids, superficial cells in surface view similar to those of lamina, many forming multicellular, often distant, paired teeth (Fig. 8i, k); from proximal limit of marginal rib to below apex of hyaline lamina composed of chlorophyllose lamina, unistratose, entire to serrulate; from above mid-hyaline lamina to leaf base sometimes with a weak intramarginal band of linear thick-walled cells in about 3–4 rows, marginal lamina uneven to notched, consisting of 3–4 rows of subquadrate to shortly rectangular, thin-walled hyaline cells (Fig. 8e). Groups of long axillary hairs occur frequently, median and distal cells of hairs seldom more than twice as long as broad (Fig. 8l). Gemmae produced from dorsal and ventral sides of the costa at and near the leaf apex; gemmae sometimes branched, sparsely papillose.

HABITAT. On tree trunks, mostly in lowland forest, but reaching over 1000 m.

DISTRIBUTION. A palaeotropical species. In addition to localities

in the Philippines cited below, also known from Mindanao.

SPECIMENS EXAMINED. **Luzon**, Cordillera, *Semper* s.n. (BM); Mt Makiling: 16 August 1931, *Herklots* P14 (BM, BM-K); 21 March 1982, *Tan & Aguila* 82–03 (BM); 6–9 December 1912, *Robinson* 17121 (BM-K). **Negros**, Oriental Province: mountains in southern part of province, 1 May 1958, *Brown* 2859 (BM, BM-K); Cuernos Mountains, Dumaguete, June 1908, *Elmer* 10387 (BM, BM-K).

The following combination of features should separate *Calymperes serratum* from other long-leaved species in the family, such as *Calymperes lonchophyllum*, *C. robinsonii*, *Syrrhopodon aristifolius* Mitt. and *S. loreus* (Sande Lac.) W.D. Reese: a) leaves curled when dry; b) hyaline lamina (in all leaves) poorly defined (i.e. with the cells of the hyaline lamina gradually merging into those of the chlorophyllose lamina); c) leaves with toothed, polystratose margins above the hyaline base; d) chlorophyllose lamina unistratose throughout; e) costa with 2(–3) layers of guide cells.

The distinguishing features separating *C. serratum* from *C. lonchophyllum* are discussed in the account of the latter.

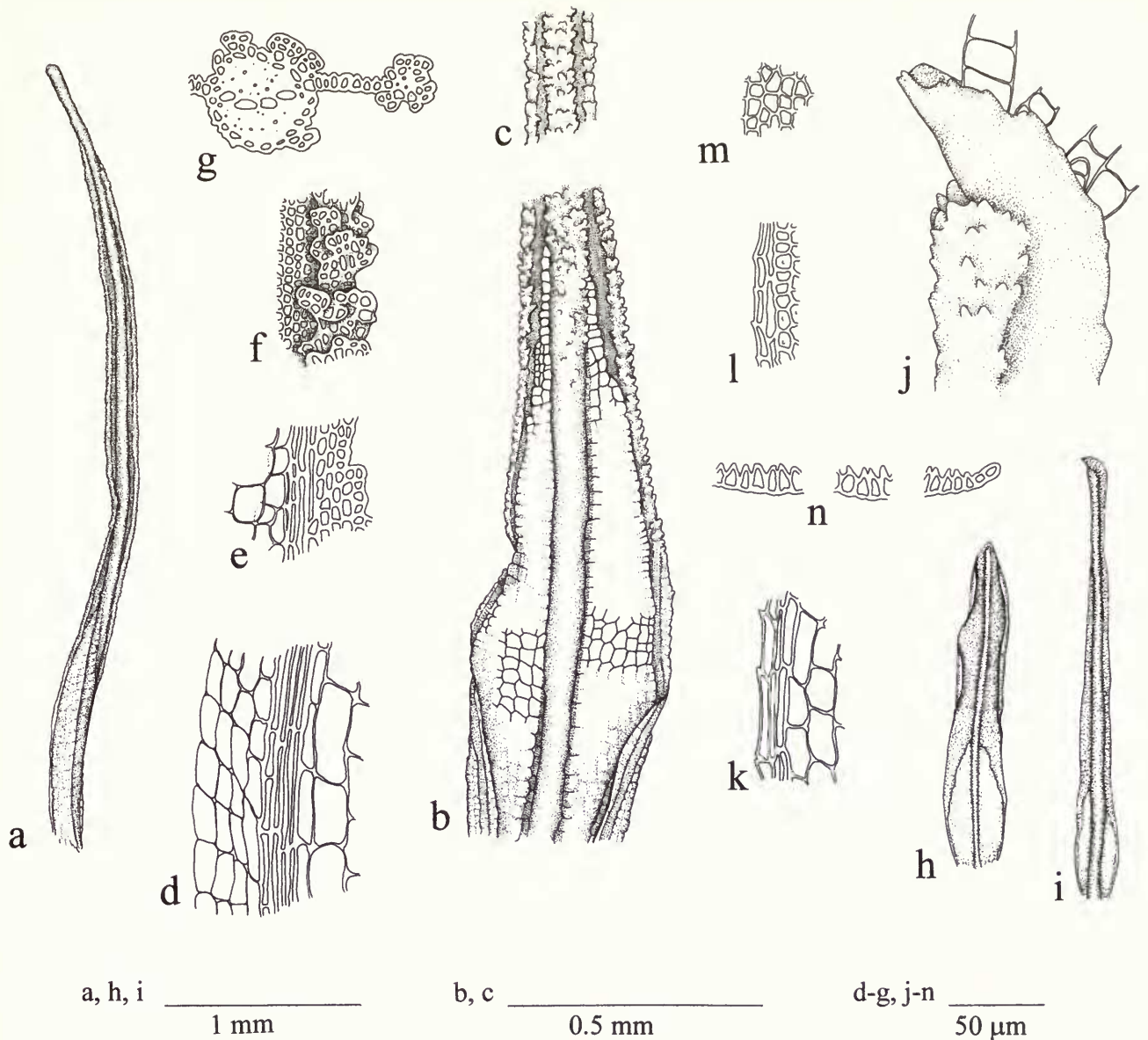


Fig. 9 a–g. *Calymperes strictifolium* (Mitt.) G. Roth a–c: leaf (a: in dorsal view, with details of b: distal region of hyaline base, c: chlorophyllose limb (dorsal view)); d–f: cells of leaf in surface view (d: at margin near leaf base, e: at margin above mid-hyaline base, f: at margin in chlorophyllose limb); g: cross-section of chlorophyllose limb. h–n *Calymperes subintegrum* Broth. h–j: leaves (h: nongemmiferous leaf in ventral view, i: gemmiferous leaf in dorsal view, with detail of j: gemmiferous apex in dorsi-lateral view); k–m: cells of leaf in surface view (k: at margin in hyaline base, l: at margin in proximal chlorophyllose limb, m: in chlorophyllose lamina); n: cross-section of chlorophyllose lamina and margin. a–g Drawn from New Guinea, Eddy 6527 (BM). h–n Drawn from Alvarez Jr 0–781138 (BM).

Calymperes strictifolium (Mitt.) G. Roth in *Hedwigia* 51: 127 (1911).

Fig. 9a–g.

Syrrhopodon strictifolius Mitt. in Seem., *Fl. vit.*: 388 (1873). Type: Samoa, Tutuila, Powell s.n. (BM!-isotype).

Syrrhopodon tuberculosus Thér. & Dixon in Dixon in *J. Linn. Soc. Bot.* 43: 303 (1916). Type: Borneo, Sekong, 22 April 1913, C.H. Binstead 84 (BM!-holotype).

Calymperes tuberculosum (Thér. & Dixon) Broth., *Nat. Pflanzenfam.* 2nd ed., 10: 240 (1924).

Shoots reaching 1.5–<2 cm high, in dark green mats. Leaves up to 5 mm long, obscurely dimorphic, linear-lanceolate, erect to erecto-

patent (Fig. 9a). Costa usually ending immediately below leaf apex, above hyaline base often occupying over a third of the width of the leaf; from distal region of the hyaline base to leaf tip covered (ventrally and dorsally) in irregular, knob-like, multicellular nodules arranged in closely set transverse rows. Blades of lamina gradually narrowing towards leaf apex; at leaf apex forming an extremely narrow band around the costal tip (often eroded away); cells of chlorophyllose lamina isodiametric to about twice as long as broad, with 4–6 sides or rounded, 5–10(–12.5) × 5–7.5 µm; ventrally bluntly to acutely protuberant, sometimes crowned with papillae, dorsally flat or slightly convex. Hyaline lamina sharply defined. Leaf margin from around distal region of hyaline base to near leaf apex consisting of a thick polystratose rib with similar ornamenta-

tion to that of the costa, sometimes incorporating stereids (Fig. 9f, g); in hyaline base similar to that in *C. afzelii*, i.e. entire; possessing a narrow, unistratose intramarginal band of linear, thick-walled cells (continuous with marginal rib in distal leaf), marginal lamina composed of hyaline, thin-walled, shortly subrectangular cells arranged in about 2–5 rows (Fig. 9d). Some leaves producing gemmae from the ventral surface of the costal apex; narrow band of chlorophyllose lamina at the leaf apex tending to be pushed backwards as the gemmae develop forming a minute concave collar around the costal tip.

HABITAT. On trunks and buttresses of trees, sometimes on logs or rocks; in damp, shady lowland rainforest.

DISTRIBUTION. An Indo-Pacific species. In the Philippines reported from Batan, Luzon and Mindanao (see Tan & Iwatsuki, 1991).

SPECIMEN EXAMINED. 'Philippine Islands', *Cuming* 2214b (BM, BM-K).

Within the Calymperaceae, multicellular nodules (Fig. 9f) are unique to the leaves of *Calymperes strictifolium*.

Calymperes subintegrum Broth. in J. Schmidt in *Bot. Tidsskr.* **24**: 119 (1901). Type: Thailand, Koh Chang, near Klong Majum, [6 January 1900], *Schmidt* [14] (H!-holotype; BM!-isotype). Fig. 9h–n.

Shoots reaching 1 cm high, forming yellowish green tufts. Leaves strongly dimorphic: nongemiferous leaves lingulate to lanceolate, upper lamina plane to involute, apex roundly subacute, 2–3(–4) mm long (Fig. 9h). Costa ending just below leaf apex; above hyaline base rough with simple, acute projections (more so on the ventral surface). Cells of chlorophyllose lamina isodiametric to slightly longer than broad with 4–6 sides, 7.5–15(–20) × 5–10(–12.5) μm (Fig. 9m), drawn out ventrally as acute, often unipapillose protuberances, dorsally smooth (Fig. 9n). Hyaline lamina sharply defined. Leaf margin above hyaline base consisting of a row of small, thick-walled, shortly rectangular cells, some projecting distally to form small teeth (Fig. 9l); in hyaline base with a narrow, unistratose (rarely bistratose), intramarginal band of linear, thick-walled cells, 1–3 cells wide (sometimes poorly developed or absent), marginal lamina composed of a single row of shortly rectangular hyaline, thin-walled cells, some projecting distally to form notches or small teeth (Fig. 9k). Gemmiferous leaves erect, linear, 3–5(–8) mm long (Fig. 9i), costa incrassate, a little less than twice the thickness of that in nongemiferous leaves. Blades of lamina from shortly beyond the hyaline base to the leaf apex narrower than costa, meeting above the costal tip to form a narrow, uneven to denticulate 'collar' (Fig. 9j). Gemmae produced from the ventral surface of the costal apex.

HABITAT. On decaying wood and boulders in moist, shady forest.

DISTRIBUTION. An Indo-Pacific species. Within the Philippines, in addition to the specimen from Luzon, cited below, this species has also been recorded from Palawan by Tan (1996).

SPECIMEN EXAMINED. Luzon, Quezon National Park, Atimonan, 16 September 1978, *Alvarez Jr* 0–781138 (BM) (new record).

The binomial, *Calymperes subintegrum*, was placed in synonymy with *Calymperes schmidtii* Broth. by Reese & Mohamed (1985). Ellis (1991) demonstrated that the holotype of the latter (Thailand, *Schmidt* 14, H) possesses features that are not shared with the type specimen of *C. subintegrum*, or those of any of its other proposed synonyms. The features of *C. schmidtii* are very similar to those of

Calymperes tenerum Müll. Hal. *Calymperes subintegrum* is the earliest name for the species described above.

Calymperes subintegrum is easily distinguished from other species with strongly dimorphic leaves occurring in the region. For example, *Calymperes porrectum* usually has recurved nongemiferous leaves with a strongly developed intramarginal rib and large multicellular teeth along the margin. In *C. subintegrum* the leaves are not recurved, and the leaf margins above the hyaline base are weakly differentiated and possess small irregularly occurring, unicellular teeth. *Chameleion peguense* (Besch.) L.T. Ellis & A. Eddy possesses leaves in which the cells of the hyaline lamina have transverse bands of thickening, and the gemmiferous leaves possess a broad, cowl-like apex (Fig. 11c). In contrast, *C. subintegrum* possesses leaves in which the cells of the hyaline lamina lack bands of transverse thickening, the gemmiferous leaves have a narrow, blunt apex, and the lamina forming the leaf apex is often obscure (Fig. 9i, j).

Calymperes subserratum M. Fleisch., *Musc. Fl. Buitenzorg* **1**: 245 (1904). Type: Java, Tjamea, 300 m, *Fleischer* s.n. (FH!-holotype). Fig. 10a–d.

Calymperes clemensiae Broth. in *Philipp. J. Sci. C. Bot.* **8**: 69 (1913). Type: Philippines, Mindanao, Camp Keithley, Lake Lamao, June 1907, *Clemens* 'T' (FH!-isotype).

Shoots <8 mm high, somewhat flattened into one plane, almost fan-like, forming mats. Stems very short, densely leaved, and often dense with rhizoids below. Leaves up to 5 mm long, not dimorphic, broadly linear, suberect to recurved, upper lamina often incurved to involute; leaf apex acute or apiculate, entire to denticulate (Fig. 10a). Costa ending immediately below, or in apex; superficial cells above hyaline base bluntly to subacutely protuberant (protuberances often more strongly pronounced towards leaf apex); internally with a single row of guide cells. Cells of chlorophyllose lamina thick-walled, mostly isodiametric, with 4–6 sides or rounded, <5–10(–12.5) × <5–7.5 μm (Fig. 10b); dorsally subacutely to bluntly protuberant; ventrally flat to convex, smooth to unipapillose (Fig. 10d). Hyaline lamina poorly defined, hyaline cells gradually merging with chlorophyllose lamina. Leaf margin unistratose; in chlorophyllose lamina often erect to incurved, entire to subdenticulate (sometimes denticulate towards the leaf apex); in hyaline lamina unistratose, entire. Long, filamentous, uniseriate, hyaline paraphyses produced in axils of some leaves.

HABITAT. On tree trunks, recorded at 300 m and 520 m (Reese & Streimann, 1994).

DISTRIBUTION. Java, New Britain and Mindanao.

No other local specimens examined.

This species, maintained as distinct by Reese *et al.* (1986), was placed in synonymy with *Calymperes serratum* A. Braun ex Müll. Hal. by Eddy (1990) and Menzel & Schultze-Motel (1990). However, Reese, Koponen & Norris (1986) and Reese & Streimann (1994) demonstrated that *Calymperes subserratum* is indeed a distinct species. Its short leaves (up to 5 mm long), with unistratose margins (Fig. 10d) are easily distinguished from those of *C. serratum*, which are mostly 10–20 mm long, with polystratose marginal ribs above the leaf base.

Calymperes taitense (Sull.) Mitt. in *J. Linn. Soc. Bot.* **10**: 172 (1868). Fig. 10e–l.

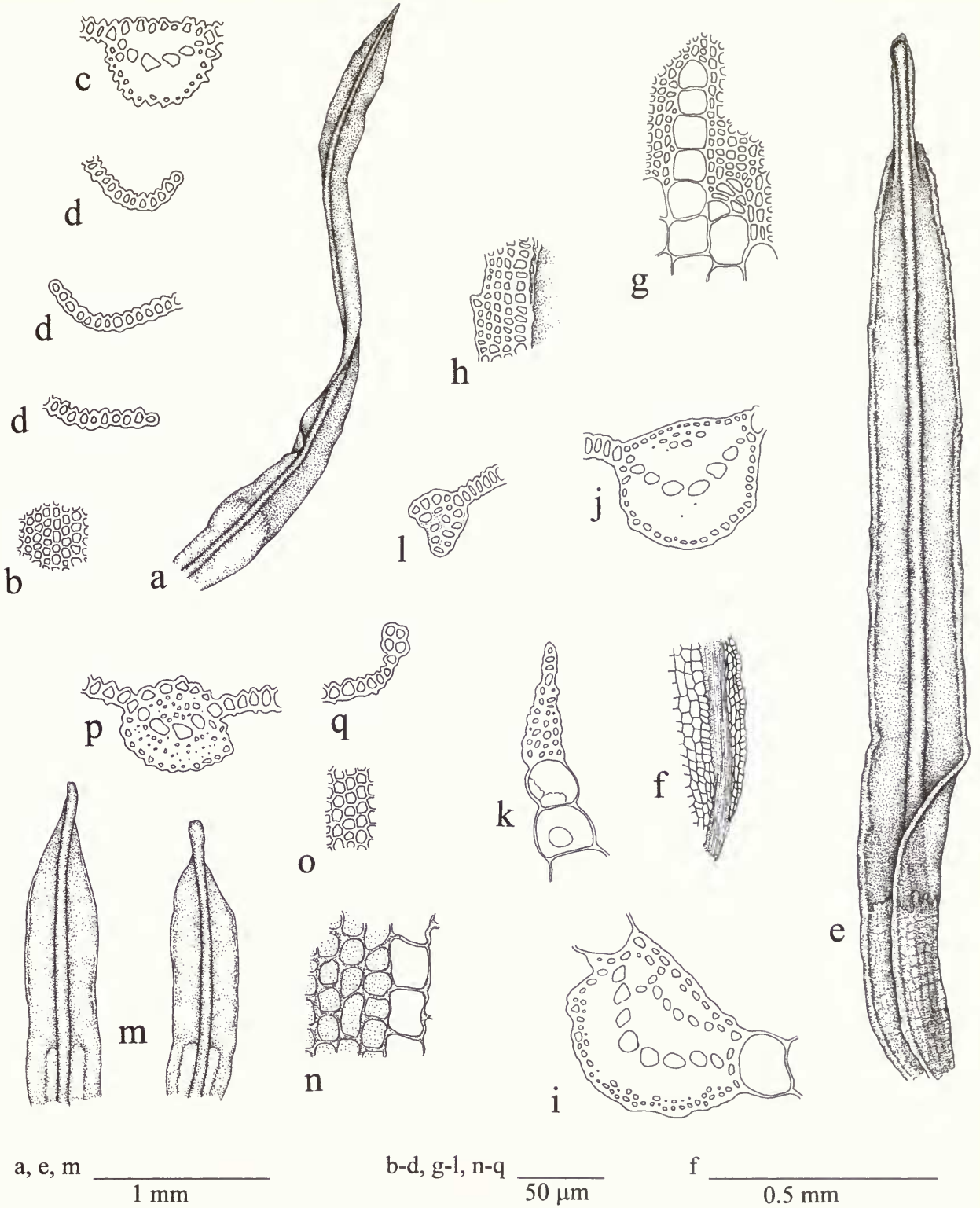


Fig. 10 a–d. *Calymperes subserratum* M. Fleisch. a: leaf; b: cells of chlorophyllose lamina (dorsal surface); c, d: cross-sections of leaf (a: costa, b: chlorophyllose lamina and margin). e–l. *Calymperes taitense* (Sull.) Mitt. e, f: leaf (e: in ventral view, f: detail of margin in proximal hyaline lamina); g–h: cells of leaf in surface view (g: around apex of hyaline lamina, h: at margin of chlorophyllose limb (ventral view)); i–l: cross-sections of leaf (i: costa in mid-hyaline base and j: in chlorophyllose limb, k: margin in hyaline base and l: in chlorophyllose limb). m–q. *Calymperes tenerum* Müll. Hal. m: leaves; n, o: cells of leaf in surface view (n: near margin in hyaline base, o: in chlorophyllose lamina); p, q: cross-sections of leaf (p: costa, q: chlorophyllose lamina and marginal rib). a–d Drawn from Java, *Fleischer* s.n. (FH). e–l Drawn from *Tan* 91–268 (BM). m–q Drawn from *Tan* 92–354 (FH).

Syrhropodon taitense Sull., *U. S. Exploring Expedition*. Musci: 6 (1860 [1859]). Type: Society Islands, Tahiti, 1838–1842, *Wilkes Expedition* s.n. (BM!-isotypes).

Calymperes orientale Mitt. ex Besch. in *Ann. Sci. Nat. Bot.* sér. 8, 1: 272, 296 (1895). Type: Borneo, Labuan, *Motley* s.n. (BM?, NY? – not found)

Calymperes orientale var. *polytrichoides* M. Fleisch., *Musc. Fl. Buitenzorg* 1: 249 (1904). Type: Salak, bei Succamandri, 500 m, *Fleischer* s.n. (L [?] – holotype, fide Reese & Mohamed, 1985).

Shoots reaching 2–>6 cm high, dull green, forming tufts. Leaves mostly 6–7.5(–9) mm long, not dimorphic, a suberect, broadly subelliptical hyaline base with an erect to spreading (moist), linear-lingulate chlorophyllose limb ending in a linear proboscis (Fig. 10e). Costa extending into proboscis, ending immediately below apex, smooth; internally with two rows of guide cells (Fig. 10j). Chlorophyllose lamina abruptly narrowing into proboscis and becoming narrowly recurved, distally becoming plane to form a blunt, dentate leaf apex (sometimes eroded away); cells mostly isodiametric, sometimes wider than long, with 4–6 sides or rounded, 5–12 × 5–7.5 µm (Fig. 10g), ventrally roundly to subacutely protuberant, dorsally smooth (Fig. 10l). Hyaline lamina sharply defined. Leaf margin from above hyaline base to near base of proboscis consisting of a thick polystratose rib (internally lacking stereids) with regular, often paired, multicellular teeth; in surface view cells isodiametric, subquadrate to irregularly rounded (Fig. 10h, i); from proximal limit of marginal rib to leaf base with a narrow unistratose to polystratose intramarginal band of linear, thick-walled cells (continuous with marginal rib of upper leaf); marginal lamina shortly below apex of hyaline lamina unistratose, denticulate, consisting of small, thick-walled, chlorophyllose cells in about 8–14 rows; in mid to proximal hyaline base entire, unistratose, consisting of 2–5 rows of subquadrate to shortly subrectangular hyaline cells (Fig. 10f). Gemmae produced from the ventral surface of the costal tip.

HABITAT. On trunks and exposed roots of trees and on rock; common in damp, shaded situations in lowland forest.

DISTRIBUTION. A palaeotropical species reaching the Pacific island groups. Widespread in the Philippines.

SPECIMENS EXAMINED. **Leyte Island**, Baybay, Mt Pangasugan, near VISCA campus, 21–22 May 1984, *Tan, Navarez & Raras* 84–216 (BM). **Luzon**, Laguna, Mt Banahao, 5–7 March 1910, *Robinson* 9805 (BM); Oriental Mindoro, Sumagit Town, Bo. Magod, vicinity of Mt Wood along River Sapadao, 11–13 July 1983, *Tan* 83–123 (FH). **Mindanao**, Seno de Davao, 15 May 1890, *Micholitz* 5 (BM, BM-K). **Palawan**, western border of St Paul Subterranean National Park, 26 May 1989, *Tan* 89–1507 (BM); Puerto Princesa, Sitio Kalabayog, near Batac Village, 23–25 April 1993, *Tan* 93–220 (FH); Barangay San Rafael, trail to Batac Village, 1 May 1991, *Tan* 91–268 (BM); Barangay Apurawan, Sitio Daan, vicinity of Mt Tinik-basan, 27 April 1992, *Tan* 92–239 (BM); *Tan* 92–243 (BM); Aborlan, Sitio Daan, Barangay Apurawan, 27 April 1992, *Tan* 92–268 (FH). **Panay Island**, Capiz province, Libacao, May–June 1919, *Martelino & Edano* 35781 (BM). **Polillo Island**, August 1909, *Robinson* 9281 (BM).

All well-developed leaves in specimens of *Calymperes taitense* possess a linear, apical proboscis (formed by the costa with narrow, recurved wings of chlorophyllose lamina). Other species of *Calymperes* and *Syrhropodon* in the Philippines either possess dimorphic leaves (in which only some produce a special, gemma-bearing apex), or leaves without apical modification of this kind.

Calymperes tenerum Müll. Hal. in *Linnaea* 37: 174 (1872). Type: India, Bengal, Calcutta, *Kurz* s.n. (BM!-isotype). Fig. 10m–q.

Shoots reaching 1 cm high, forming green mats. Leaves often homomallously curled when dry, up to 3 mm long, hardly dimorphic, obovate to lingulate with distal chlorophyllose lamina sometimes involute, leaf apex broadly acute (Fig. 10m). Costa usually excurrent, sometimes ending in apex, in distal leaf superficial cells often forming rounded to acute projections. Cells of chlorophyllose lamina mostly 7–12.5 × 7–10(–12.5) µm, isodiametric with 4 to 6 sides or rounded (Fig. 10o), ventrally drawn out as acute projections, dorsally flat or unipapillose (Fig. 10q). Hyaline lamina usually sharply defined, enclosed on either side by broad, unistratose, marginal bands of small quadrate to shortly rectangular cells with differentially thickened walls and/or angles (Fig. 10n). Leaf margins entire, beyond hyaline lamina sometimes unistratose but usually formed by a narrow polystratose rib of small isodiametric chlorophyllose cells, lacking stereids (Fig. 10q). Gemmiferous leaves with excurrent costa; gemmae produced from all around the costal tip.

HABITAT. On living and fallen trees and exposed tree roots, sometimes on rock; occurring in lowland areas.

DISTRIBUTION. A pantropical species. Widespread in the Philippines.

SPECIMENS EXAMINED. **Lumbacan Island**, October 1906, *Elmer* 5279 (BM). **Luzon**, Laguna, UPLB campus, 20 July 1985, *Tan* s.n. (FH). **Palawan**, Barangay Apurawan, Sitio Daan, vicinity of Mt Tinikbasan, 27 April 1992, *Tan* 92–258 (FH); El Nido, 5 January 1992, *Tan* 92–354 (FH); Port Barton, 1992, *Tan* 92–315 (FH). Iwahig, Balsahan, 23 April 1993, *Tan* 93–188 pro parte (FH). **Culion Island**, Culion, Sister Convent Garden, 8 May 1992, *Tan* 92–347 (BM). **Ursula Island**, Barangay Rio Tuba, 29 April 1993, *Tan* 93–257 (FH).

The hyaline base in the leaves of *Calymperes tenerum* and *C. motleyi* are almost identical. For a comparison of these species see under description of the latter.

Chameleion L.T. Ellis & A. Eddy in A. Eddy, *Handbook of Malesian Mosses* 2: 250 (1990). Type species: *Chameleion cryptocarpos* (Dozy & Molck.) L.T. Ellis & A. Eddy.

Syrhropodon section *Heliconema* Mitt. in *J. Linn. Soc. Bot.* 12: 112 (1869).

Heliconema (Mitt.) L.T. Ellis & A. Eddy in L.T. Ellis in *J. Bryol.* 15: 728 (1989), *hom. illeg.*

Shoots erect, simple or branched, often matted with rhizoids, forming mats or tufts. Leaves sometimes dimorphic (gemmaiferous and nongemmaiferous leaves), mostly lingulate, ligulate to oblong-lanceolate, consisting of hyaline, or partly hyaline base that usually narrows slightly into a chlorophyllose limb, apices truncate or rounded to broadly subacute, sometimes apiculate. Costa ending below apex, sometimes with short lamellae on ventral surface. Cells of chlorophyllose lamina small, mostly isodiametric, usually ventrally protuberant, smooth or papillose. Cells of hyaline lamina large, empty, smooth, porose, walls often with transverse bands of thickening; border between hyaline and chlorophyllose lamina often poorly defined. Marginal and/or intramarginal ribs frequently present, marginal ribs in chlorophyllose limb sometimes with short lamellae. Gemmae produced, often in radial groups, sometimes from the apices of modified leaves. Perichaetia terminal. Seta very short. Capsule urn-shaped, immersed among the upper leaves of the shoot. Peristome syrrhopodontoid or absent.

The name, *Chameleion*, was proposed by Ellis & Eddy in Eddy (1990) who also presented a short history of this segregate genus. As

a genus, the group resembles many small species of *Calymperes* in features of the gametophyte and *Syrrhopodon* in details of the sporophyte.

There are three species recognized in this small tropical genus, only one of which, *Chameleion peguense*, has been recorded in the Philippines. This species is probably now extinct here as it has not been refound since its original collection from Mt Lumutan, Rizal Province in 1917. The mountain vegetation has subsequently become largely secondary forest, and grassland of *Imperata cylindrica* (L.) Rusch.

The status of the genus *Chameleion* requires further research. The species included within the genus (*C. cryptocarpus* (Dozy & Molk) L.T. Ellis & A. Eddy, *C. peguense* and *C. xanthophyllus* (Mitt.) L.T. Ellis & A. Eddy) are united by the possession of capsules on very short setae that remain immersed among the leaves of the gametophyte. *Chameleion xanthophyllus* and *C. cryptocarpus* occur in tropical America and *C. peguense* has an Indo-Malesian distribution.

The leaves in the species of *Chameleion* are similar in form, but those of *C. xanthophyllus* lack some features shared by the leaves of *C. peguense* and *C. cryptocarpus*. For example, leaves in the latter two species possess hyaline cells in the basal lamina with unevenly thickened walls and series of large, subrectangular, transversely elongate, superficial pores; some cells on the ventral surface of the costa and those of the marginal rib in the chlorophyllose limb form short lamellae (only evident in well-developed specimens of *C. peguense*). These features are absent from the leaves of *C. xanthophyllus*.

Reese (1993) points out similarities between the leaves of *C. xanthophyllus* and *Syrrhopodon rigidus* Hook. & Grev. and some allied species (a group with exserted capsules, well accepted as belonging to the genus *Syrrhopodon*). He suggests that immersed capsules may have arisen more than once within the Calymperaceae and, therefore, undermines one of the principal justifications for recognizing the genus *Chameleion*. Similarities in the leaves of the species of *Chameleion* are said to be superficial. However, which features of these species of *Syrrhopodon* and *Chameleion* reflect their interrelationships requires greater clarification; a detailed cladistic analysis may help to resolve the problem. Presently, *Chameleion* appears to be worthy of retention.

Chameleion peguense (Besch.) L.T. Ellis & A. Eddy in A. Eddy, *Handbook of Malesian Mosses* 2: 250 (1990).
Fig. 11.

Calymperes peguense Besch. in *Ann. Sci. Nat. Bot.* ser. 8, 1: 269, 299 (1895). Type: Burma, Pegu, Yomah, Kurz 2928b (BM!-holotype).

Calymperes ramosii Broth. in *Philipp. J. Sci.* 31: 281 (1926). Type: Philippines, Luzon, Province of Rizal, Mt Lumutan, July 1917, Ramos & Edano 29825 (BM!-isotypes).

Heliconema peguense L.T. Ellis & A. Eddy in *J. Bryol.* 15: 730 (1989), *hom. illeg.*

Syrrhopodon peguense (Besch.) W.D. Reese in *J. Hattori Bot. Lab.* 82: 243 (1997).

Shoots 0.5–1.5 cm high, densely matted with rhizoids below, forming mats or tufts. Leaves strongly dimorphic: nongemmiferous leaves erect to patent (sometimes recurved), mostly 3–4 mm long, narrowly to broadly lingulate, distal lamina often incurved; apex broadly obtuse to rounded or rounded-truncate, entire (Fig. 11a). Costa ending just below apex; on the ventral surface near costal apex sometimes with one or two low lamellae (2–3 cells high); ventral superficial cells above the hyaline base subquadrate to shortly rectangular, smooth to roundly or subacutely protuberant, dorsal

superficial cells similar but mostly longer relative to width and often with a shallow, simple papilla near end walls; internally with a single row of guide cells. Cells of chlorophyllose lamina isodiametric to slightly longer than broad, with 4–6 sides or rounded-elliptical, 5–12.5(–15) × 5–10 µm (Fig. 11f); ventrally roundly protuberant, dorsally flat to slightly convex or unipapillose (Fig. 11h). Hyaline lamina often poorly defined, adjacent to costa sometimes incorporating thick-walled, brownish yellow cells; largely composed of fragile hyaline cells, superficial walls with transverse bands of thickening (areas between thickened bands sometimes becoming pores) (Fig. 11e). Leaf margins above hyaline base entire to irregularly and distantly toothed (teeth blunt), sometimes unistratose but usually incorporating an intramarginal polystratose rib with superficial cells in surface view subquadrate to shortly subrectangular and often with an internal strand of stereids, dorsal surface of rib sometimes with one or two entire or distantly and bluntly toothed lamellae (1–3 cells high), marginal cells similar to laminal cells, forming a unistratose band 2–3 cells wide; in region around distal limit of hyaline lamina unistratose, entire to denticulate; in hyaline base incorporating an intramarginal, unistratose band of long rectangular to linear thick-walled cells (up to about 7 cells wide); marginal cells hyaline, shortly subrectangular, forming a single row (entire below, distally entire to denticulate).

Gemmiferous leaves linear with a funnel-shaped apex, stiffly erect (curved when dry), exserted well above nongemmiferous leaves, c. 5 mm long (Fig. 11b, c). Costa strong (occupying over a third of the leaf width), ending below apex, distally rough with many superficial cells drawn out as acute projections; internally with 1–3 layers of guide cells between dorsal and ventral bands of substereids (Fig. 11i). Chlorophyllose lamina usually involute, at apex forming a lax funnel-shaped collar above the tip of the costa; cells subquadrate to long subrectangular; dorsally and ventrally convex or drawn out as acute projections. Hyaline lamina narrow with cells similar to those in nongemmiferous leaves. Leaf margins above hyaline base similar to those in nongemmiferous leaves but lacking lamellae (some superficial cells of intramarginal polystratose rib acutely drawn out); in hyaline base intramarginal band of linear cells often obscure or absent. Gemmae produced in a radial mass from the ventral surface of the costal apex (within the ‘laminal collar’). Perichaetia terminal. Seta >0.5 mm long. Capsule urn-shaped, >1 mm long. Peristome syrrhopodontoid with 16 papillose teeth.

HABITAT. On trunks, branches and exposed roots of trees; occurring from near sea level to over 600 m.

DISTRIBUTION. Disjunct from India, Indochina and Luzon Island in the Philippines.

No other local material examined.

Plants of this species are similar to those of some small species of *Calymperes* with dimorphic leaves (e.g. *C. boulayi*, *C. subintegrum*), but the leaves possess lamellae on the costa and leaf margins (in well-developed specimens), and the cells of the hyaline lamina have transverse bands of thickening. Sporophytes are very rare.

Mitthyridium H. Rob. in *Phytologia* 32: 432 (1975). Type species: *Mitthyridium fasciculatum* (Hook. & Grev.) H. Rob.

Thyridium Mitt. in *J. Linn. Soc. Bot.* 10: 188 (1869), *hom. illeg.*

Plants forming mats, primary shoots creeping, often with short ascending secondary branches. Leaves when dry variously curled, when moist mostly spreading; consisting of a suberect, often

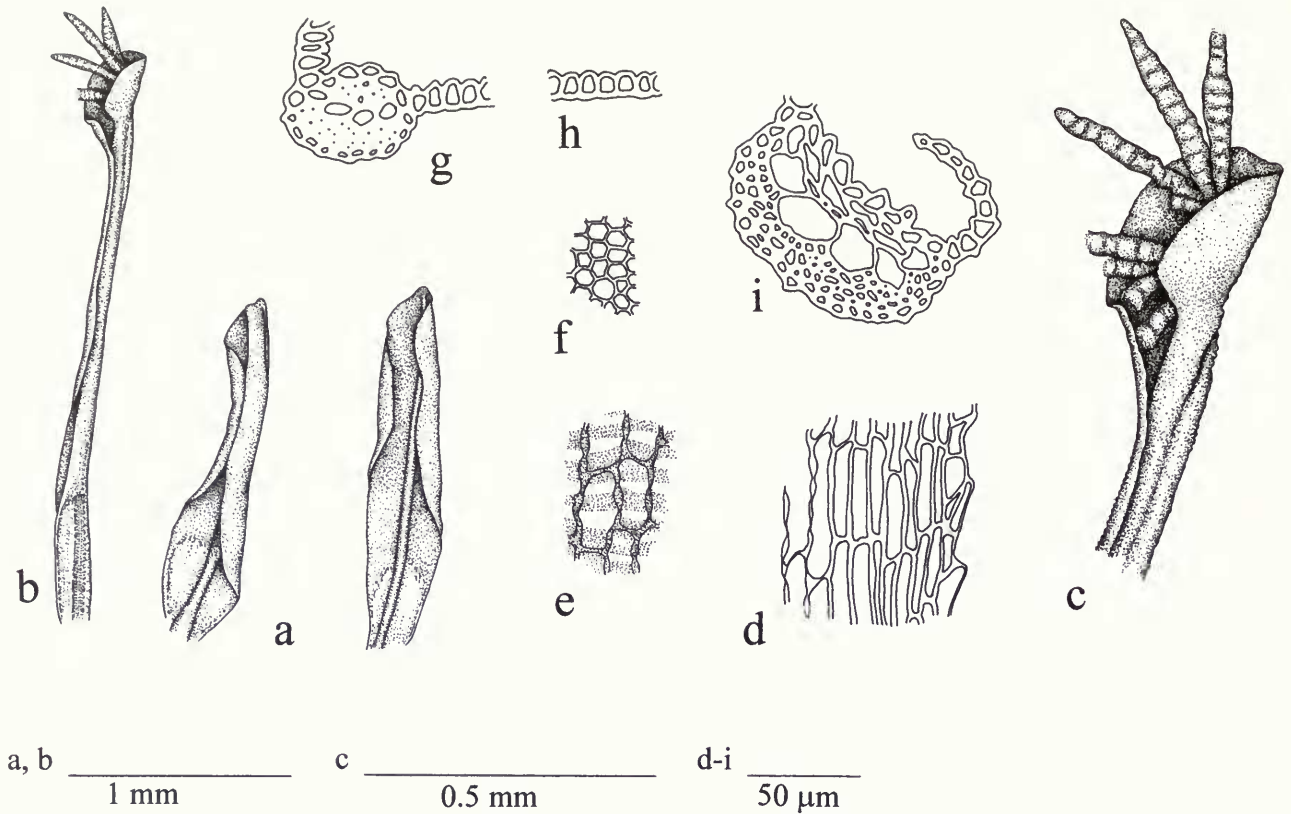


Fig. 11 a–h. *Chameleion peguense* (Besch.) L.T. Ellis & A. Eddy a: nongemiferous leaves in ventral view; b, c: gemmiferous leaf (b: in lateral view, with c: detail of gemmiferous apex); d–f: cells of leaf in surface view (d: at margin in hyaline base, e: in hyaline lamina, f: in chlorophyllose lamina); g–h: cross-sections of nongemiferous leaf (g: costa, h: chlorophyllose lamina); i: cross-section of gemmiferous leaf through chlorophyllose limb. a–i Drawn from Ramos & Edano 29825 (BM).

semiclasping hyaline base narrowing (sometimes abruptly) into a lingulate or lanceolate to triangular-lanceolate chlorophyllose limb. Costa ending below apex, usually smooth, sometimes with small, sparse teeth; internally composed of dorsal and ventral bands of stereids with a single, median layer of guide cells, superficial cells sometimes differentiated. Cells of chlorophyllose lamina small, thick-walled, mostly isodiametric, polygonal to rounded or substellate, not usually protuberant, often multipapillose. Hyaline lamina well defined. Leaf margin mostly with a unistratose marginal rib of linear thick-walled cells extending from the base into the upper leaf. Calymperoid gemmae produced near and/or at apices of leaves (apices strongly modified in some species). Sporophytes terminal; seta smooth; capsule exserted, erect, cylindrical. Calyptra rostrate, fugacious. Peristome syrrhopodontoid.

Mitthyridium is a small genus most closely related to *Syrrhopodon*, and is easily recognized by its creeping primary stems and broad leaf borders (in most species the leaf border is unistratose, an exception is the Indonesian species *Mitthyridium retusum* (Besch.) W.D. Reese in which the marginal rib is polystratose). The distribution of *Mitthyridium* is almost exclusively palaeotropical with only a single historical collection of a wide-ranging species recorded from South America (Reese, Mohamed & Mohamed, 1986). *Mitthyridium* occurs exclusively at low altitudes.

The species of *Mitthyridium* are highly variable and consequently have been differently interpreted by various authors. In this treatment, we have accepted a number of infraspecific taxa which reflect the morphological variations observed in specimens from the Philippines.

There are 12–13 species of *Mitthyridium* reported from Malesia. Eight are described below for the Philippine archipelago, of which one, *M. iwatsukianum* B.C. Tan is a local endemic.

Mitthyridium constrictum (Sull.) H. Rob. in *Phytologia* **32**: 432 (1975).

Fig. 12a–c.

Calymperes constrictum Sull., *U. S. Exploring Expedition*. Musci: 6 (1860 [‘1859’]). Type: Hawaii [‘Sandwich Island’] *Wilkes Expedition* s.n. (FH-lectotype).

Shoots reaching *c.* 6 cm long, sparsely branched, densely leaved, forming stringy tufts and mats. Leaves sometimes in lax ranks, mostly 2.5–<3.0 mm long, subobovate with upper lamina involute, lower leaf suberect and clasping, upper leaf curled when dry, erect to spreading when moist; apex modified as a loosely tubular to funnel-shaped proboscis (tip mostly truncate) (Fig. 12a). Costa ending below leaf apex; dorsal surface near leaf apex scabrid with spinose teeth, otherwise smooth, composed of stereids/linear cells. Cells of chlorophyllose lamina 10–15(–17.5) × 7.5–>12.5 μm, with very thick walls (abutting cell walls sometimes as broad as lumina), longer than broad to broader than long, irregularly polygonal to substellate, multipapillose below (papillae mostly thick and simple, rarely obscure) (Fig. 12b); towards leaf apex on dorsal leaf surface usually becoming unipapillose (papillae prominent, sometimes branched). Hyaline lamina sharply defined, occupying just less than a third of the leaf length. Leaf margins irregularly notched to

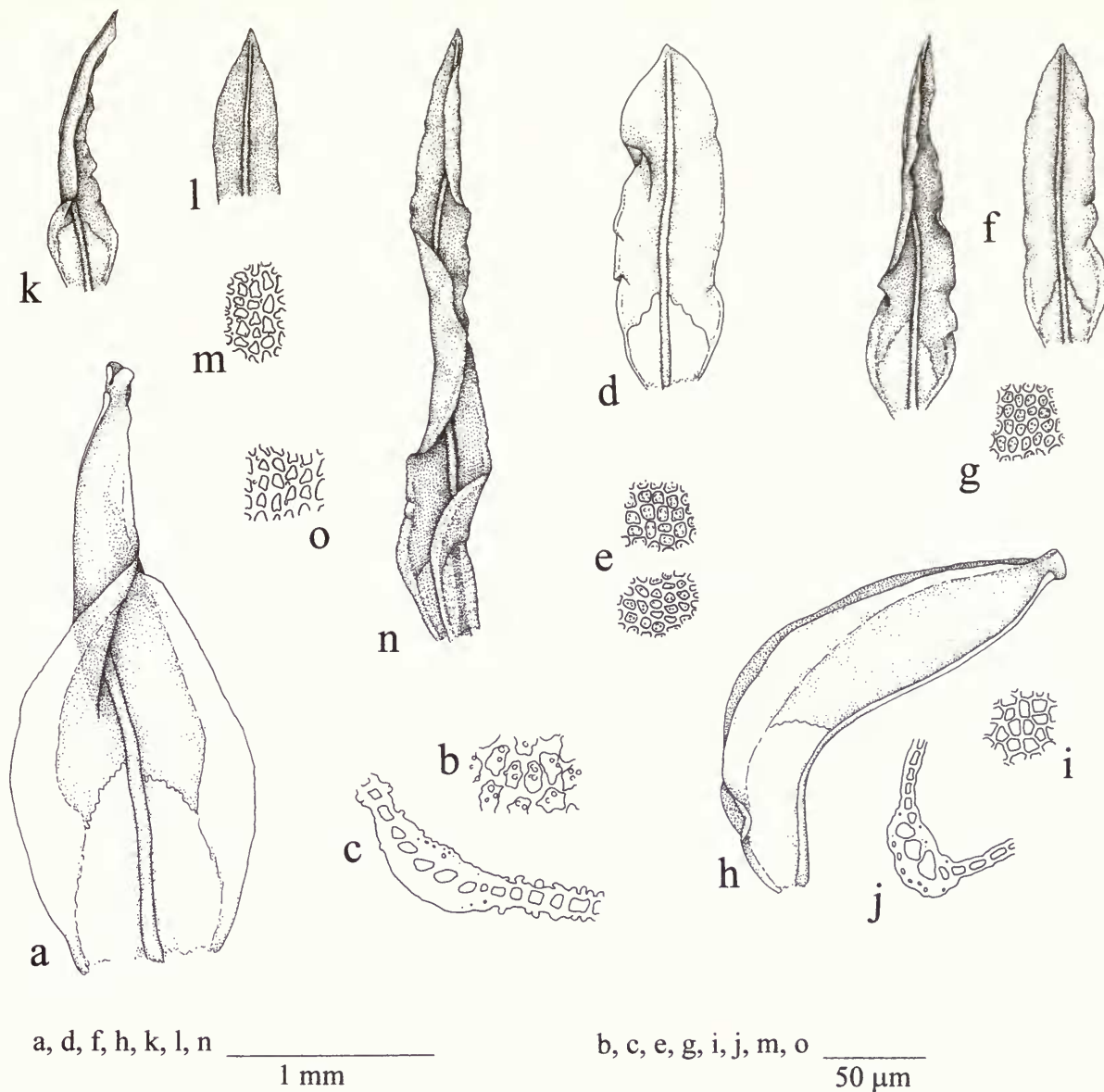


Fig. 12 a–c. *Mitthyridium constrictum* (Sull.) H. Rob. a: leaf; b: cells of chlorophyllose lamina; c: cross-section of costa and chlorophyllose lamina. d, e. *Mitthyridium flavum* (Müll. Hal.) H. Rob. d: leaf; e: cells of chlorophyllose lamina. f, g. *Mitthyridium* cf. *flavum*? f: leaves; g: chlorophyllose lamina. h–j. *Mitthyridium iwatsukianum* B.C. Tan h: leaf in lateral view; i: cells of chlorophyllose lamina; j: cross-section of costa and chlorophyllose lamina. k–m. *Mitthyridium junquilianum* (Mitt.) H. Rob. k: leaf in ventral view, with l: detail of distal chlorophyllose limb; m: cells of chlorophyllose lamina. n, o. *Mitthyridium subluteum* (Müll. Hal.) H. Novak n: leaf in ventral view; o: cells of chlorophyllose lamina. a Drawn from Tahiti, Whittier 2351 (BM). b, c Drawn from Louisades, Micholitz s.n. (BM). d, e Drawn from Tan 87–20 (FH). f, g Drawn from Sabah, Ellis 95–289 (BM). h–j Drawn from Tan & Tandang 82–371 (BM). k–m Drawn from Borneo, Motley s.n. (BM). n, o Drawn from Tan & Hernaez 87–449 (BM).

denticulate from a short distance above leaf base to near apex; marginal rib very broad, 100–250(–400) μm wide at broadest point (adjacent to or slightly above distal hyaline lamina). Gemmae produced from ventral surface of costal apex (enfolded in incurled lamina of proboscis).

HABITAT. On tree trunks and branches in lowland forest.

DISTRIBUTION. An Indo-Pacific species. Uncommon in the Philippines.

SPECIMEN EXAMINED. Luzon, Tayabas, Mt Binaung, May 1917, Ramos &

Edano 28941 (FH) (duplicate in BM is *M. fasciculatum*).

Mitthyridium constrictum is superficially very similar to *M. iwatsukianum* B.C. Tan. In *M. iwatsukianum* the leaves lie in three very neat ranks along the stem and the cells of the chlorophyllose lamina are subquadrate to irregularly polygonal, smooth, with narrow, evenly thickened walls. *M. constrictum* possesses leaves that lie in lax, untidy ranks and the cells of the chlorophyllose lamina are papillose with uneven walls which are often almost as broad as the lamina they define.

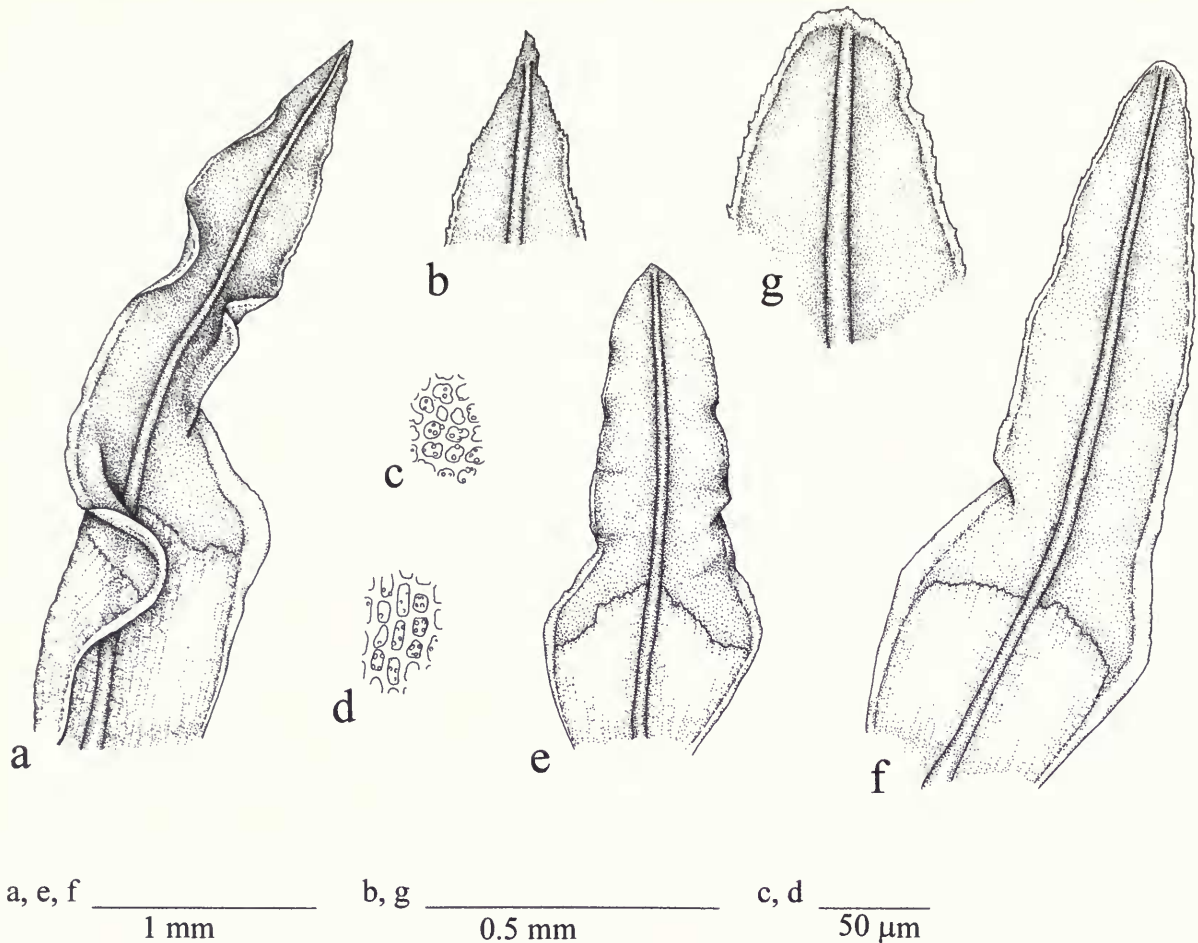


Fig. 13 a–d. *Mithyridium fasciculatum* (Hook. & Grev.) H. Rob. a, b: leaf (a: in ventral view, with b: detail of apex); c, d: cells of leaf in surface view (c: in chlorophyllose lamina, d: in ventral surface of costa). e. *M. fasciculatum* subsp. *cardotii* (M. Fleisch.) B.C. Tan & L.T. Ellis e: leaf. f, g. *M. fasciculatum* subsp. *obtusifolium* (Lindb.) M. Menzel f, g: leaf (f: in ventral view, with g: detail of apex). a–d Drawn from Java, *Eddy* s.n. (BM). e Drawn from Tan, Navarez & Raros 84–218 (FH). f, g Drawn from Tahiti, *Whittier* 2172 (BM).

Mithyridium fasciculatum (Hook. & Grev.) H. Rob. in *Phytologia* 32: 43 (1975).

Mithyridium fasciculatum (Hook. & Grev.) H. Rob. subsp. ***fasciculatum***
Fig. 13a–d.

Syrhropodon fasciculatus Hook. & Grev. in *Edinburgh J. Sci.* 3: 225 (1825). Type: Ternate Island, [C. Smith] s.n. (Hb. Dickson) (BM!-lectotype, fide Menzel & Schultze-Motel (1990)).

Thyridium fasciculatum (Hook. & Grev.) Mitt. in *J. Linn. Soc. Bot.* 10: 189 (1868).

Syrhropodon leucoloma Müll. Hal. in *Bot. Jahresber (Just.)* 5: 86 (1883). Type: New Guinea, September 1875, Naumann s.n. (BM!-isotype).

Syrhropodon codonoblepharoides Müll. Hal. ex M. Fleisch., *Musc. Fl. Buitenzorg* 1: 228 (1904), *nom. nud.* Original material ?; Philippines, Cuming 2199 (in Hb. Hampe, BM!).

Mithyridium leucoloma (Müll. Hal.) H. Rob. in *Phytologia* 32: 433 (1975).

Primary shoots reaching >8 cm, occasional ascending branches reaching >3 cm long, forming coarse stringy tufts and mats, densely

leaved. Leaves 3.5–5 mm long, consisting of a subobovate, semisheathing hyaline base narrowing abruptly into a broadly lanceolate to lingulate chlorophyllose limb (curled when dry, spreading when moist); leaf apex subacute to acute (Fig. 13a, b). Costa ending below leaf apex; dorsal surface composed of long rectangular to linear cells (some projecting distally); ventral surface above hyaline base composed of a (sometimes broken) layer of subquadrate to shortly subrectangular multipapillose cells, in hyaline base cells becoming slightly larger, smooth, thin-walled and hyaline. Chlorophyllose lamina strongly undulate; cells in surface view <5–12 × <5–10 µm, isodiametric, subquadrate to irregularly polygonal or appearing to consist of 2–4 rounded lobes, multipapillose (papillae appearing to overlie lumina) (Fig. 13c). Hyaline lamina sharply defined with a broadly-pointed, almost truncate apex. Leaf margins irregularly denticulate (and papillose) from above mid-hyaline base to leaf apex; marginal rib extending from leaf base to near apex, broadest adjacent to distal hyaline lamina (c. 15–>20 cells wide). Gemmae produced from near and at apex of costa.

HABITAT. Generally a lowland species. In the Philippines *Mithyridium fasciculatum* has been collected from tree trunks and logs between 400 m and 800 m.

DISTRIBUTION. A palaeotropical species with doubtful reports from tropical America. Widespread in the Philippines.

SPECIMENS EXAMINED. **Philippines**, *Cuming* s.n. (BM). **Luzon**, Mountain Province: June 1952, *Mack* 1395 (FH); Benguet, Mt Data, 26 March 1938, *Santos* 961 (BM, FH); Quezon Province, Atimonan: Quezon National Park, 9 March 1986, *Tan & Lipaygo* s.n. (FH); Malinao, 26 October 1937, *Santos* 857 (FH); Tayabas: Alabat, Mt Camagong, 22 October 1937, *Santos* 806 (FH); Mt Binuang, May 1917, *Ramos & Edano* 28941 (BM) (duplicate in FH is *M. constrictum*). **Mindanao**, Lanao, Dansalan, 29 September 1938, *Zwickey* 225b (FH). **Mindoro Island**, Lake Naujan, 15 April 1935, *Bartlett* 13561 (FH). **Palawan**, Puerto Princesa, Barangay Irawan, Mt Malinao, 4 May 1993, *Tan* 93–302 (FH); Barangay Napsan, Sitio Tagkuit, Salakot waterfall vicinity, 2 May 1993, *Tan* 93–264 (FH).

Nowak (1980), Eddy (1990), and Reese & Stone (1995) recognized *Mitthyridium leucoloma* as a distinct species. Menzel & Schultze-Motel (1990) placed *M. leucoloma* in synonymy with *M. fasciculatum* while Reese, Koponen & Norris (1986) placed it in synonymy with *M. obtusifolium* (Lindb.) M. Menzel. Reese & Stone (1995) distinguish *M. leucoloma* from *M. fasciculatum*, and other taxa, by the possession of leaves with entire margins (sometimes weakly denticulate) and with the upper lamina more or less involute; there is a 'lack of flaring at the leaf shoulders', and the cells at the apex of the hyaline lamina 'interfinger' with the proximal cells of the chlorophyllose lamina. In *M. fasciculatum* the leaves possess denticulate margins, an upper lamina not notably involute, flaring shoulders, and cells in the apex of the hyaline lamina not notably interfingering with the proximal cells of the chlorophyllose lamina. However, these apparently contrasting features may represent extremes in a range of variation. In the isotype specimen of *M. leucoloma* (*Naumann* s.n., BM) there are many leaves with well-developed denticulate margins, an upper lamina not notably involute, and with somewhat flaring shoulders. A range of specimens, including the type of *M. leucoloma*, differ to varying degrees from the typical form of *M. fasciculatum* in the features outlined above. Whether these form a group distinct at the level of species remains equivocal.

Nowak (1980) identifies two collections from the Philippines (one from Mindanao, the other unlocalized) as *Mitthyridium leucoloma*.

Mitthyridium fasciculatum* subsp. *cardotii (M. Fleisch.) B.C. Tan & L.T. Ellis, **stat. nov.**
Fig. 13e.

Thyridium cardotii M. Fleisch., *Musc. Fl. Buitenzorg* **1**: 228 (1904).
Type: Java, Buitenzorg Botanical Garden, January 1899, *Fleischer* (*Musc. Frond. Archip. Indici* Ser. II, exs. no. 73 (BM!-isotypes)).
Mitthyridium cardotii (M. Fleisch.) H. Rob. in *Phytologia* **32**: 432 (1975).

Mitthyridium fasciculatum var. *cardotii* (M. Fleisch.) A. Eddy, *Handbook of Malesian Mosses* **2**: 135 (1990).

Differs from the type subspecies in having smaller shoots (<4 cm long), branches (<1 cm long) and leaves (up to c. 2.5 mm long) with obtuse apices (Fig. 13e).

HABITAT. On trunks of trees in lowland forest.

DISTRIBUTION. Largely an Indo-Malesian subspecies, but apparently occurring as far west as the Seychelles. In addition to the localities in the Philippines cited below, this subspecies has also been reported from Leyte and Negros by Iwatsuki & Tan (1980).

SPECIMENS EXAMINED. **Leyte Island**, Baybay, Mt Pangasugan, near VISCA campus, 21–22 May 1984, *Tan, Navarez & Raros* 84–218 (FH). **Luzon**,

Isabela, San Mariano, Barrio Disulap, Sierra Madre range, Dimahahabong Creek, 14 April 1991, *Tan* 91–119 (BM).

Reese, Koponen & Norris (1986) and Menzel & Schultze-Motel (1990) regard subspecies *cardotii* as a mere form of the type subspecies. However, Eddy (1990) proposed subspecies *cardotii* as a formal variety of *Mitthyridium fasciculatum*. The research of G. Jakab (pers. comm.) indicates that subspecies *cardotii* is not confined to Indo-Malesia, but also occurs in the Seychelles, where, hitherto, it has been treated as a distinct species, *Mitthyridium micro-undulatum* (Dixon) H. Rob.

Mitthyridium fasciculatum* subsp. *obtusifolium (Lindb.) M. Menzel in M. Menzel & W. Schultze-Motel in *Willdenowia* **19**(2): 502 (1990).

Fig. 13f, g.

Syrhropodon obtusifolium Lindb. in *Öfvers. Förh. Kongl. Vetensk.-Acad.* **21**: 605 (1865) ['1864']. Type: Tahiti, September 1852, *Pontén* s.n. (BM!-lectotype, BM!-isotype (fide Nowak (1980))).

Thyridium obtusifolium (Lindb.) M. Fleisch., *Musc. Fl. Buitenzorg* **1**: 228 (1904).

Mitthyridium obtusifolium (Lindb.) H. Rob. in *Phytologia* **32**: 434 (1975).

Specimens of subsp. *obtusifolium* differ from those of the type subspecies in the possession of leaves with an obtuse apex (Fig. 13f, g), the rows of laminal cells forming the apical margin smooth and thicker walled than those below; the apex of the hyaline lamina tending to be truncate (rather than broadly acute) and the marginal rib generally broader. A collection from Luzon, *Tan & Lipaygo* s.n. (cited above under subsp. *fasciculatum*), possesses leaves with somewhat obtuse apices that approach halfway the characteristic form found in subsp. *obtusifolium*. In all other features, the leaves of this specimen are identical to those of subsp. *fasciculatum*. Unequivocal evidence for the presence of this subspecies in the Philippines has yet to be discovered.

Mitthyridium flavum (Müll. Hal.) H. Rob. in *Phytologia* **32**: 433 (1975).

Fig. 12d–g.

Syrhropodon flavus Müll. Hal. in *Bot. Zeitung (Berlin)* **13**: 763 (1855). Type: Java, s.n. (B?-holotype, presumably destroyed 1943; isotypes not found).

Thyridium flavum (Müll. Hal.) M. Fleisch., *Musc. Fl. Buitenzorg* **1**: 232 (1904).

Syrhropodon luzonensis R.S. Williams in *Bull. New York Bot. Gard.* **8**: 338 (1914). Type: Philippines, Luzon, Lamao River, 90 m, March 1904, *Williams* 824 (FH!-isotype).

Thyridium luzonensis (R.S. Williams) Broth., *Nat. Pflanzenfam.* 2nd ed., **10**: 236 (1924).

Primary shoots prostrate, sometimes dense with rhizoids, <0.5–>2.0 cm long, unbranched to dense with very short ascending branches. Leaves mostly 1.5–>2 mm long, erect to spreading from a semi-sheathing hyaline base, lingulate, usually parallel-sided and abruptly narrowing at the apex to form a shortly pointed tip (Fig. 12d), sometimes gradually narrowing from hyaline base. Costa ending below apex, surface composed largely of stereids, some occasionally projecting at their distal ends to form minute teeth; lateral superficial cells sometimes shortly rectangular (at leaf apex sometimes producing gemmae). Cells of chlorophyllose lamina in surface view 5–10 × 5–12.5 µm, slightly longer than broad to slightly

broader than long, irregularly polygonal or rounded, each with 1–4 simple papillae on the dorsal and ventral surfaces (papillae sometimes obscure) (Fig. 12e). Hyaline lamina sharply defined, often with an acute apex. Leaf margins plane to undulate, with a narrow, unistratose rib of linear cells extending from the leaf base to distal leaf limb, 2–8 cells wide (broadest adjacent to distal hyaline lamina), sinuose to denticulate, rarely entire; margins toward leaf apex formed by cells of chlorophyllose lamina, entire to denticulate.

HABITAT. On shaded tree trunks in forest.

DISTRIBUTION. An Indo-Pacific species. Widespread in the Philippines.

SPECIMENS EXAMINED. **Leyte Island**, Baybay, Mt Pangasugan near VISC A campus, 21–22 May 1984, *Tan, Navarez & Raros* 84–217 (FH). **Luzon**, Bataan, Olongapo Naval Reservation, 25 May 1935, *Bartlett* 14114 (FH); Cagayan, hills at Sitio Babayuan, 30 October 1935, *Bartlett* 14926 (FH); *Bartlett* 14931 (FH); Isabela, Palanan Wilderness, 19 May 1992, *Tan* 92–205 (BM); Zambales, Candelaria, Bo. Tapaso, Mt Lanat, 15–16 March 1987, *Tan* 87–20 (FH). **Mindoro Island**, Mt Bulalacao, November 1939, *Ebalo* 231 (FH). **Palawan**, Mt Mantalingahan, between Nalpuan and Sandurapi, 26 April 1991, *Tan* 91–186 (BM); Aborlan, Barangay Apurawan, trail to Sitio Daan, 28 April 1992, *Tan* 92–297 (FH); Taytay, Lake Manguao (Lk Danao), 1 May 1992, *Tan* 92–311 (BM); Puerto Princesa, Barangay Irawan, Mt Malinao, 4 May 1993, *Tan* 93–316 (FH); Puerto Princesa, Sitio Kalabayog, near Batac Village, 23, 25 April 1993, *Tan* 93–221 (FH). **Sibuyan Island**, Magdiwang, Bo Tampayan, Mt Giting-Giting, 21 May 1987, *Tan & Hernaez* 87–455 (FH).

The holotype of *Mitthyridium flavum* was presumably destroyed along with the major part of Müller's herbarium (B) in 1943. Should the apparent absence of isotype material be real the species may require neotypification. Müller (1856), in his review of Dozy and Molkenboer's *Bryologia Javanica*, provides a strong indication of his concept of *M. flavum*. Referring to the illustrations of *Syrhropodon tenellum* Dozy & Molk. he proposes that the latter species is conspecific with his earlier described *Syrhropodon flavus*. These illustrations, and relevant material derived from Dozy and Molkenboer's herbarium (now in Hb. Hampe (BM) and Hb. Schimper (BM-K)), show features that agree with the concept of *M. flavum* as presently understood (Eddy, 1990; Menzel & Schultze-Motel, 1990; Reese, Koponen & Norris, 1986).

Most specimens can be identified as *Mitthyridium flavum* by their short leaves (>2 mm long) with parallel sides. The leaves in *M. repens* (Harv.) H. Rob. also have parallel sides, but are usually much smaller (1–1.5 mm long) and possess rounded-apiculate apices, not evident in the leaves of *M. flavum* (Fig. 14b).

Mitthyridium iwatsukianum B.C. Tan in *Mem. New York Bot. Gard.* **45**: 453 (1987). Type: Philippines, Laguna, Cavinti Town, Bo. Lumot, near Sitio Ubali, 500–800 m, 24 October 1982, *Tan & Tandang* 82–371 (BM!-isotype).

Fig. 12h–j.

Shoots reaching >4 cm long, with sparse branches up to about 1 cm long (shoots and branches with a flattened appearance). Leaves strictly aligned in three ranks, mostly 2.5–3 mm long, subobovate, subrecurved from a clasping base, folded along costa; apex modified as a loosely tubular to funnel-shaped proboscis (Fig. 12h). Costa ending below leaf apex, smooth (dorsal surface of the costal apex lacking spinose teeth). Chlorophyllose lamina smooth; cells small, mostly 5–12.5(–15) × 5–12.5(–15) µm, subquadrate to irregularly polygonal (never substellate), broader than long to longer than broad, with relatively narrow and evenly thickened walls (Fig. 12i). Hyaline lamina sharply defined, occupying just less than one third of the leaf length. Leaf margins irregularly notched to minutely den-

ticulate from a short distance above the leaf base to near apex; marginal rib very broad, reaching 300–350 µm wide at its broadest point (near apex of hyaline lamina). Gemmae produced from ventral surface of costal apex (enfolded in incurled lamina of proboscis).

HABITAT. On leaf sheath of *Pinanga* palm in lowland rainforest.

DISTRIBUTION. Philippine endemic.

Known only from the type collection. Eddy (1990) draws attention to the strong similarities between *Mitthyridium iwatsukianum* and *M. constrictum*. However, their differences, most strikingly those of the chlorophyllose lamina (Fig. 12b, i), presently justify the recognition of *Mitthyridium iwatsukianum* as a species. Similar diverse forms of chlorophyllose lamina occur as extremes of a range of variation in *Mitthyridium wallisii*; intermediates between the forms of lamina in *M. iwatsukianum* and *M. constrictum* have yet to be found.

Mitthyridium papuanum (Broth.) H. Rob. in *Phytologia* **32**: 434 (1975).

Fig. 14i–o.

Syrhropodon papuanus Broth. in *Oefvers. Förh. finska Vetensk.-Soc.* **37**: 156 (1895). Type: New Ireland, October 1893, *Micholitz* [94] (BM!-isolectotypes, fide Nowak (1980)).

Thyridium papuanum (Broth.) M. Fleisch., *Musc. Fl. Buitenzorg* **1**: 232 (1904).

Primary shoots reaching >4 cm long, with sparse ascending branches <1–>3 cm long. Leaves 2–4 mm long, broadly lanceolate (gradually tapering from distal hyaline base to an acute apex) to lingulate (with parallel sides from base to near apex, at apex rapidly contracted into a subapiculate to apiculate, sometimes acuminate, point) (Fig. 14i, j); curved when dry, spreading when moist. Costa ending in apex; ventral and dorsal surfaces above midleaf largely formed by stereids, below midleaf formed by rectangular, thick-walled cells; on dorsal surface towards apex occasionally some cells giving rise to a small tooth from their distal ends. Chlorophyllose lamina undulate; cells mostly 5–12.5 × 5–10 µm, quadrate to irregularly polygonal, or rounded, usually with evenly thickened walls, on dorsal and ventral surfaces with 1 or more simple papillae (papillae often obscure) (Fig. 14k). Leaf margin from shortly above leaf base to apex minutely and irregularly denticulate; marginal rib extending from leaf base, broadest adjacent to hyaline lamina, tapering to beyond midleaf (Fig. 14l). Gemmae produced at leaf apex from shortly rectangular, lateral cells of costa.

HABITAT. On tree trunks, mostly in lowland forest.

DISTRIBUTION. A widespread Indo-Pacific species.

SPECIMENS EXAMINED. **Dalupiri Island**, 31 October–5 November 1935, *Bartlett* 15843 (FH). **Luzon**, Mt Makiling, 27 August 1931, *Herklots* P28 (BM, FH); Isabela, Palanan Wilderness, 19 May 1992, *Tan* 91–222 (BM); 20 May 1992, *Tan* 92–213 (FH); Tayabas, Alabat, Mt Camagong, 21 October 1937, *Santos* 810 (FH).

Reese, Koponen & Norris (1986) placed *Mitthyridium papuanum* in synonymy with *M. luteum* (Mitt.) H. Rob. and identified material from the Philippines as that species. Reese (1994) and Reese & Stone (1995) reinstated *M. papuanum* as a distinct species.

The lectotype of *Mitthyridium luteum*, from Fiji (*Milne* 363, BM), is like a form of *M. fasciculatum* with relatively narrow, tapering leaves. The chlorophyllose lamina is composed of strongly papillose cells with incrassate walls. Many of the leaves in the type, and other specimens of *M. papuanum*, are parallel-sided and resemble giant forms of those occurring in *Mitthyridium flavum*. In *M. papuanum*,

the cells of the chlorophyllose lamina are relatively thin-walled and possess low papillae that, even in cross-section, are barely visible. Evidence from material presently available does not justify including *M. papuanum* in synonymy with *M. luteum*, and specimens from the Philippines, previously identified as *M. luteum*, are referable to *M. papuanum*. *Mitthyridium luteum* remains a good species based on Milne 363.

Mitthyridium repens (Harv.) H. Rob. in *Phytologia* **32**: 434 (1975). Fig. 14a–h.

Syrhropodon repens Harv. in Hook., *Icon. Pl.* **1**: t. 22, fig. 4 (1836); Harv. in Harv. & Hook. in *J. Bot. (Hooker)* **2**: 7 (1840). Type: Peninsular Malaysia, Pinang ['Penang'], Wallich [H.1204] (BM-K!-holotype?).

Thyridium repens (Harv.) Mitt. in *J. Linn. Soc. Bot.* **10**: 188 (1868).

Primary shoots prostrate, forming mats, obscured by densely crowded, short, simple or innovating, ascending branches. Ascending branches 1–7 mm high, densely leaved, sometimes densely matted with rhizoids below. Leaves <1–1.5 mm long, consisting of an erect, subrectangular hyaline base (slightly and gradually widening from base to apex) narrowing slightly and gradually into an erect to spreading (moist), lingulate chlorophyllose limb (tightly incurled when dry); leaf apex abruptly narrowing, broadly rounded or broadly rounded and subapiculate to apiculate, entire (Fig. 14a, b). Costa ending below leaf apex; surface near costal apex often composed of subrectangular cells (surface view), surface below apical region composed of stereids. Cells of chlorophyllose lamina in surface view 5–12.5(–15) × 5–12.5 µm, longer than broad to broader than long, irregularly rounded to elliptical or appearing to consist of 2–4 (or more) rounded lobes; on dorsal and ventral surfaces each with several simple papillae (Fig. 14e, d). Hyaline lamina sharply defined with a somewhat truncate apex. Leaf margins plain to undulate (intermittently incurved); from below leaf apex to base consisting of a flattened band of stereids; from below leaf apex to around apex of hyaline lamina gradually broadening to c. 40–65 µm wide, regularly and sharply denticulate (Fig. 14c); below apex of hyaline lamina to leaf base slightly narrowing, entire to uneven. Gemmae produced towards and at leaf apex from ventral surface of costa.

HABITAT. On trunks and buttresses of trees in lowland areas.

DISTRIBUTION. An Indo-Pacific species. Philippine records are all from Luzon.

SPECIMENS EXAMINED. Luzon, Quezon, Real, National Botanic Garden, 4 August 1985, Tan & Wijangco s.n. pro parte (BM); Bataan Province, Mt Mariveles, July 1904, Leiberg 1215 (FH).

Mitthyridium repens has the smallest shoots of any species of *Mitthyridium* occurring in the Philippines. It often forms thin, dense mats resembling those of some diminutive species of *Macromitrium* and *Schlotheimia* in the family Orthotrichaceae.

Mitthyridium subluteum (Müll. Hal.) H. Nowak in *Bryophyt. Biblioth.* **20**: 144 (1980). Type: Samoa, Upolu, Graeffe s.n. (BM!-isolectotype).

Fig. 12n–o.

Codonoblepharum subluteum Müll. Hal. in *J. Mus. Godeffroy* **3**(6): 67 (1874).

Primary shoots prostrate, up to 2 cm long with sparse short branches. Leaves 3–3.5 mm long, lanceolate to linear-lanceolate with undulate margins (mostly 5–7 times longer than broad, slightly broadening from base to around distal extent of the short hyaline lamina, then

tapering to an acute to narrowly acuminate apex) (Fig. 12n). Costa ending immediately below leaf apex; surface largely smooth (a few sparse teeth sometimes evident near leaf apex), above leaf base formed by stereids, in ventral leaf base formed by rectangular cells with mostly thin, porose walls. Chlorophyllose lamina occupying about six sevenths of leaf length, sometimes incurved above; cells 7.5–15 × 7.5–12.5 µm, irregularly polygonal, subelliptical or appearing to consist of 2–4 rounded lobes; with walls unevenly thickened and several simple papillae (sometimes obscure) (Fig. 12o). Leaf margin denticulate from shortly above base to apex; marginal rib extending from base to near apex, often only 1–2 cells wide distally. Gemmae produced at leaf apex and from some dorsilateral cells of the costa for some distance below the leaf apex.

HABITAT. In the Philippines collected from tree trunks up to 1100 m.

DISTRIBUTION. A Malesian species. Previously reported, but with no specimen citation, as occurring in Mindanao (Reese, Mohamed & Mohamed, 1986; Menzel & Schultze-Motel, 1990).

SPECIMEN EXAMINED. Sibuyan Island, Magdiwang, Barangay Tampayan, Mt Giting-Giting, 21 May 1987, Tan & Hernaez 87–449 (BM).

The features of the collection from Sibuyan (Fig. 12n, o), cited above, accord especially well with those of the type of *Mitthyridium subluteum*. The latter has been widely accepted as representing a long-leaved (3–3.5 mm) form of *M. junquilianum* (Mitt.) H. Rob. in which the hyaline lamina often occupies a relatively small proportion (about one seventh) of the leaf length (Eddy, 1990; Menzel & Schultze-Motel, 1990; Reese, Koponen & Norris, 1986). Mohamed & Reese (1992) convincingly argue that *M. junquilianum* and *M. subluteum* are separate species. The present authors have not seen material from the Philippines that can safely be identified as *M. junquilianum*. The leaves of the isotype of *M. junquilianum* (Borneo, Motley s.n., BM) are relatively short (c. 2 mm) with the hyaline lamina often occupying about a quarter of the leaf length (Fig. 12k). Material recently collected in Sabah (e.g. Ellis 89–289, BM, UMS) possesses leaves that are not constant in form; some taper from around the apex of the hyaline base and closely resemble the leaves in the isotype of *M. junquilianum* (BM), whilst others (from the same shoot) are nearly parallel-sided and resemble the leaves of *M. flavum* (Fig. 12f). Consequently, this specimen is difficult to identify with certainty. The relationship between *M. junquilianum* and *M. flavum* requires further investigation.

Mitthyridium wallisii (Müll. Hal.) H. Rob. in *Phytologia* **32**: 435 (1975).

Fig. 15.

Syrhropodon wallisii Müll. Hal. in *Linnaea* **38**: 555 (1874). Type: Philippines, Luzon, Mahahai, 200 ft, 1870, Wallis s.n. (BM!-isotype; FH!-isotype).

Shoots prostrate to ascending, in densely packed mats, with dense, ascending branches, mostly <0.5–1 cm long, densely leaved. Leaves mostly 1.5–2.5 mm long, consisting of a semisheathing hyaline base narrowing into a lingulate to narrowly triangular chlorophyllose limb (spreading when moist, incurled and crisped when dry), apex modified as a loosely tubular to narrowly funnel-shaped proboscis (often apiculate, sometimes emarginate) (Fig. 15a, b). Costa ending below apex (occasionally slightly excurrent as a mucro), surface formed by stereids, smooth (Fig. 15f). Cells of chlorophyllose lamina mostly 5–12.5 × 5–12.5 µm; longer than broad to broader than long, with irregularly polygonal to substellate lumina; thick-walled, smooth or papillose (papillae appearing to overlie cell walls)

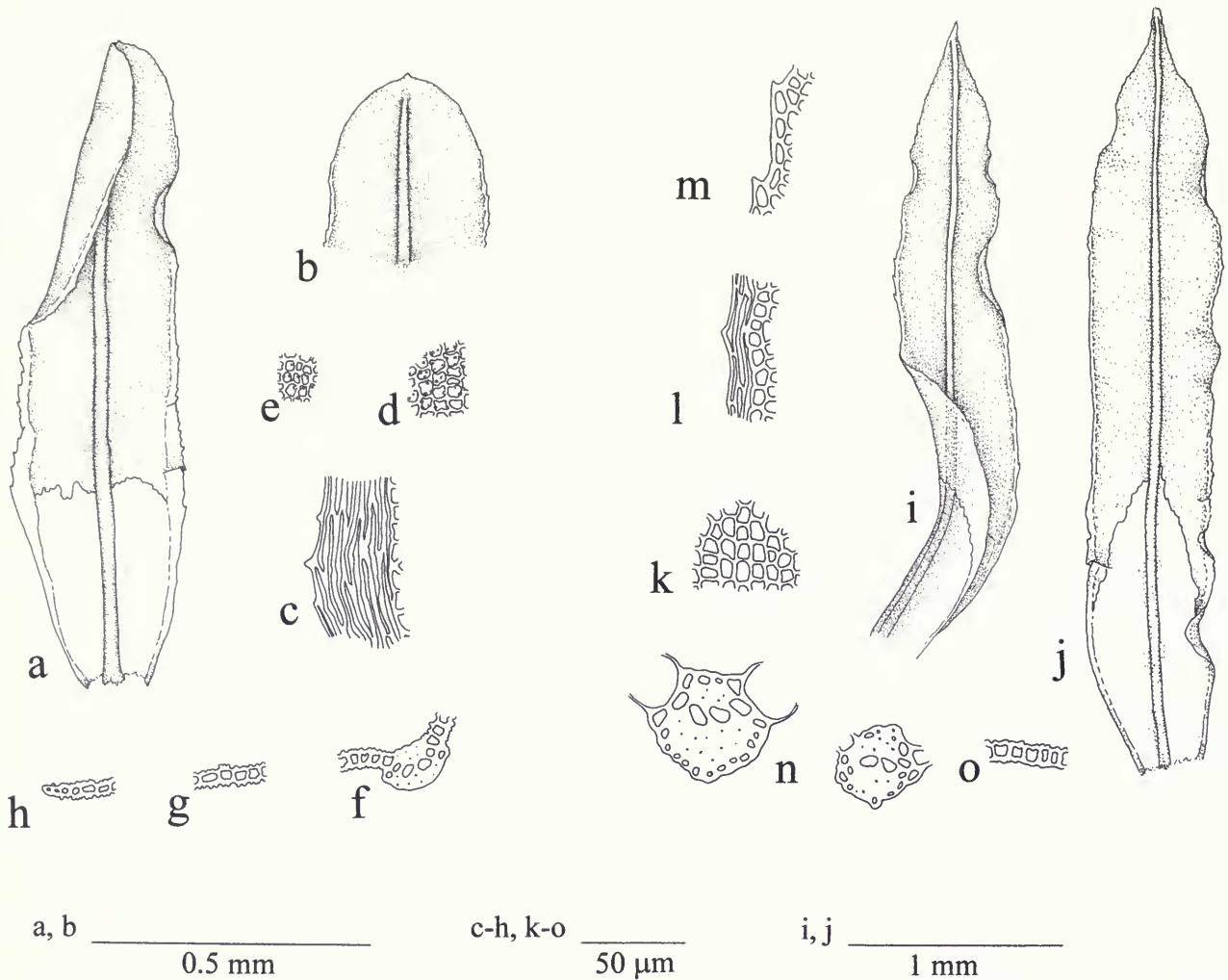


Fig. 14 a–h. *Mitthyridium repens* (Harv.) H. Rob. a, b: leaf (a: in ventral view, with b: detail of apex); c–e: cells of leaf in surface view (c: at margin above apex of hyaline lamina, d: of chlorophyllose lamina above apex of hyaline lamina, e: of distal chlorophyllose lamina); f–h: cross-sections of leaf (f: costa, g: chlorophyllose lamina, h: margin in chlorophyllose limb. i–o. *Mitthyridium papuanum* (Broth.) H. Rob. i, j: leaves (ventral view); k–m: cells of leaf in surface view (k: in chlorophyllose lamina, l: of margin near leaf apex, m: of margin near leaf apex); n, o: cross-sections of leaf (n: costa, o: chlorophyllose lamina). a–h Drawn from Tan & Wijangco s.n. pro parte (BM). i Drawn from Micholitz 94 (BM). j–o Drawn from Tan 91–222 (BM).

(Fig. 15d, e). Leaf margin in hyaline base mainly entire; from distal hyaline base to near apex minutely and irregularly denticulate, in apical region entire to irregularly crenulate-denticulate; marginal rib extending from base of leaf to beyond midleaf, broadest adjacent to distal extent of hyaline lamina (c. 7–10 cells wide, <50 µm). Gemmae produced from ventral surface of costa at leaf apex (enfolded within incurled lamina of proboscis).

HABITAT. On logs and tree trunks.

DISTRIBUTION. A Malesian species, common in the Philippines.

SPECIMENS EXAMINED. Luzon, Laguna, Cavinti Town, Sitio Calminoe, 25–26 February 1984, Tan & Trenbatt 84–50 (BM, FH); Quezon: Atimonan, 13 December 1980, Cadiz Fe Misa 12 (FH); Real, National Botanic Garden, 4 August 1985, Tan & Wijangco s.n. (FH); Tayabas, 17 September 1935, Pastrana 53 (FH); Guinayangan, February 1929, Doldulao 84421 (FH). Negros Island, Gimagon River, 6 January 1904, Copeland 73 (BM, FH); Dumaguete, November 1935, Chapman 41 (FH); May 1906, Whitford 1572 (BM). Panay Island, Capiz, October–November 1925, Edano 46254 (FH).

Sibuyan Island, Magdiwang, Barangay Tampayan, Mt Giting-Giting, 21 May 1987, Tan & Hernaez 87–442 (BM).

The cells of the chlorophyllose lamina in *Mitthyridium wallisii* vary widely in the thickness of their walls. At one extreme these cells possess relatively broad lumina and walls with unevenly thickened angles and sides (Fig. 15e); at the other extreme the walls appear broader than the lumina (Fig. 15d).

All material of *Mitthyridium wallisii* from the Philippines, examined for this study, is referable to the type variety. *Mitthyridium wallisii* var. *crassum* (Broth.) M. Menzel, with a largely Malesian distribution, possesses leaves reaching c. 4 mm long (approaching twice the length of most leaves seen in the type variety), which entirely lack the funnel-shaped apex present in some leaves in var. *wallisii*.

Syrhropodon Schwägr., *Sp. musc. frond. suppl.* 2: 110 (1824). Type species: *Syrhropodon gardneri* (Hook.) Schwägr.

Plants in tufts or mats, shoots erect, simple or branched, often

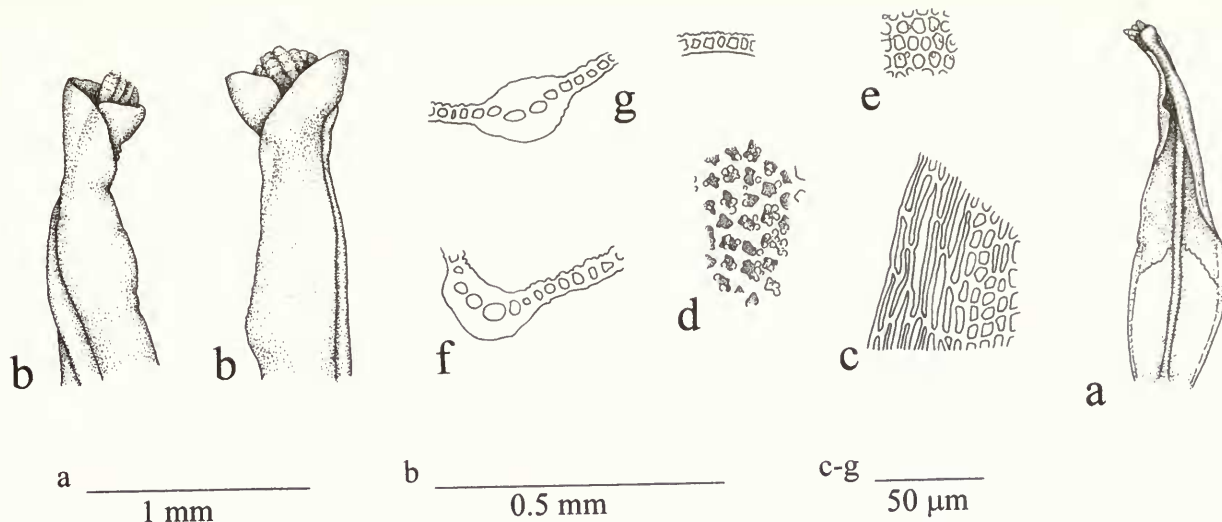


Fig. 15 a–g. *Mithridium wallisii* (Müll. Hal.) H. Rob. a, b: leaf (a: in ventral view, with b: detail of gemmiferous apex; c–e: cells of leaf in surface view (c: at margin adjacent to apex of hyaline lamina, d, e: of chlorophyllose lamina); f, g: cross-sections of costa and chlorophyllose lamina. a–d, f Drawn from *Wallis* s.n. (BM). e, g Drawn from *Tan & Wijangco* s.n. (FH).

densely matted with rhizoids below. Leaves when dry variously curled and twisted, when moist mostly erect to spreading or recurved; consisting of an erect to suberect, largely hyaline, semisheathing base extending (usually abruptly narrowing) into a ligulate, lingulate or linear chlorophyllose limb. Costa ending just below apex to shortly excurrent, superficial cells linear to subrectangular, smooth or giving rise to teeth, spines, cilia or coronate papillose projections; internally composed of 1(–2) layers of guide cells between dorsal and ventral bands of stereids. Cells of chlorophyllose lamina quadrate, shortly rectangular, irregularly polygonal or rounded, broader than long to longer than broad, smooth and flat, or producing spines, teeth or papillose projections from dorsal and/or ventral surfaces of the leaf. Leaf margin often differentiated (nearly always so in the hyaline base); in proximal hyaline base usually consisting of a flattened rib of thick-walled linear cells, most often unistratose and entire; in distal leaf base often with spines, teeth or cilia; interrupted by chlorophyllose lamina, or continuing into upper leaf; in chlorophyllose limb obscure to strong, or absent, consisting of stereids and/or subrectangular, irregularly polygonal cells in 1–several layers; entire, denticulate, dentate, spinulose, or ciliate. In many species gemmae produced from the costa, most often from the costal apex (in a few species produced on specialized leaves). Sporophytes terminal; seta smooth; capsule exserted, erect, cylindrical. Peristome haplolepidous (lacking in some species), with 16 teeth (usually ridged and/or papillose); hyaline properistome often evident. Operculum rostrate; calyptra cucullate, fugacious.

Syrrhopodon is the largest genus in the Calymperaceae and has the broadest latitudinal and altitudinal ranges. Several species have reached the temperate regions of Asia and North America (Reese, 1987b). In the Philippines, the genus is primarily a corticolous moss of lowland rainforest, although several species occur on humid boulders. A few have successfully penetrated the montane or cloud forests above 1000 m.

Syrrhopodon lacks autapomorphic characters, and consequently, has been thought to represent the ancestral or primitive form in the family Calymperaceae (Reese, 1987b). Yet, the genus also has the largest number of endemics or locally derived species. There are about 30 Malesian species of *Syrrhopodon*, of which 19 are reported below for the Philippine archipelago.

Syrrhopodon alboginatus Schwägr., *Sp. musc. frond. suppl.* 2(1): 131 (1824). Type: Moluccas, Rauwack Island, *Gaudichaud* [14A (H. 1230)] (BM!-isotype).

Fig. 16a–f.

Syrrhopodon micholitzii Müll. Hal. in Paris, *Index Bryol.*: 1253 (1898), *nom. nud.* Original specimen: Philippines, Mindanao, Surigao, Jaganan, March 1896, *Micholitz* 171 (FH).

Shoots slender, <1–>3.5 cm high, in tufts or mats, with a scolopendroid appearance, sometimes dense with rhizoids below. Leaves close-set, mostly 3–3.5(>4.0) mm long; each consisting of an erect, semisheathing, narrowly elliptical hyaline base extending into a spreading to recurved, linear (slightly twisted) chlorophyllose limb with an acute to subacute dentate apex (Fig. 16a–d). Costa ending in apex, superficial cells shortly to long rectangular, above hyaline base some giving rise to subtransverse rows of acute teeth; internally with a single row of guide cells between dorsal and ventral layers of stereids. Cells of chlorophyllose lamina mostly isodiametric, rounded, quadrate, shortly rectangular or irregularly polygonal, smooth, mostly 7–12.5 × 5–10 µm, at short regular intervals along the leaf limb (on both dorsal and ventral surfaces) forming largely unbroken, oblique to transverse rows of acute, distally leaning teeth (Fig. 16e). Marginal rib continuous from leaf base to near apex, entire, above proximal hyaline base polystratose, composed of stereid cells, obscured in distal leaf where the margins of the chlorophyllose lamina become tightly incurved and apparently form a denticulate leaf margin. Sporophytes occasional, seta 5–7 mm long, capsule c. 1.5 mm long, erect, narrowly cylindrical; peristome teeth papillose; operculum with a long, erect, narrow, subulate beak.

HABITAT. On decaying logs and tree stumps in lowland forest.

DISTRIBUTION. A widespread Indo-Pacific species. Very common in the Philippines.

SPECIMENS EXAMINED. Luzon, Laguna Province, Los Banos, Mt Makiling, June–July 1917, *Elmer* 18457 (BM); Mt Makiling, 17 August 1931, *Herklots* P22 (BM); Siniloan, U.P. Quezon Land Grant, 3 January 1882, *Baldovino* 001 (BM); San Antonio, September–October 1912, *Ramos* 16670 (BM); Sierra Madre Range, 16 December 1985, *Tan* s.n. (FH); Aurora Province,

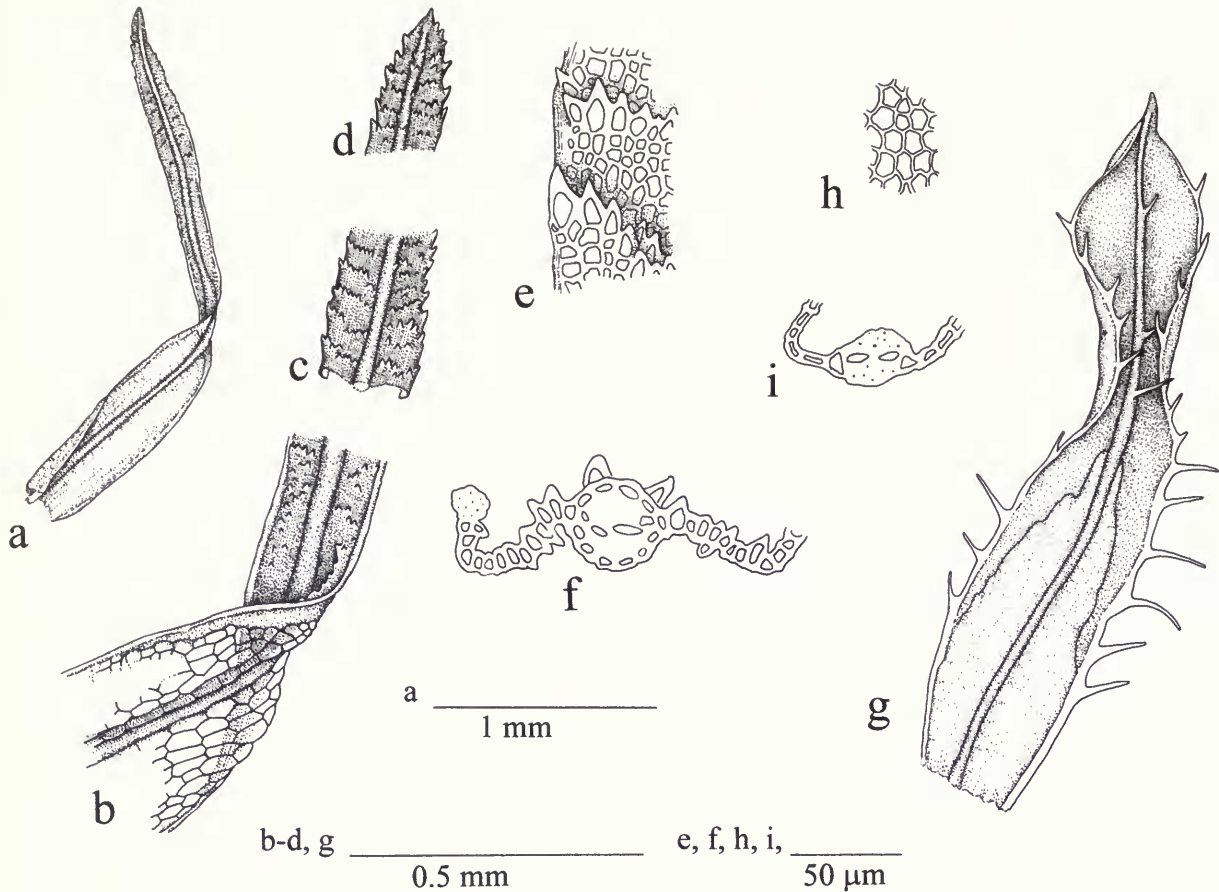


Fig. 16 a–f. *Syrrhobodon albobaginatius* Schwägr. a–d: leaf (a: dorsal aspect, with details of b: apex of hyaline lamina, c: mid-chlorophyllose limb, d: apex); e: cells of chlorophyllose lamina in surface view; f: cross-section of chlorophyllose limb. g–i. *Syrrhobodon ciliatus* (Hook.) Schwägr. g: leaf in ventral view; h: cells of chlorophyllose lamina in surface view; i: cross-section of costa and chlorophyllose lamina. a–d Drawn from *Tan* 92–210 (BM). Drawn from *Tan* 93–320 (FH). g–i Drawn from *Micholitz* 165 (BM).

Sierra Madre Range, 23 October 1980, *Alvarez* 0–801367 (BM); Isabela Province, Palanan Wilderness, 20 May 1992, *Tan* 92–210 (FH). **Mindanao**, Sunlug, Seno de Davao, 12 May 1890, *Micholitz* 4 (BM); March 1896, *Micholitz* 171 (BM); Zamboanga Province, Basilan City, Lamitan, 4 May 1948, *Santos* 4075 (BM); 25 May 1949, *Santos* 4301 (BM). **Mindoro**, between Bongabon and Pinamalayan, February–April 1941, *Maliwanag* 312 (FH). **Palawan**, Puerto Princesa, Barangay Irawan, Mt Malinao, 4 May 1993, *Tan* 93–320 (FH); between Roxas and Port Barton, 1992, *Tan* 92–374B (FH). **Panay**, Capiz Province: Libacao, May–June 1919, *Martelino & Edano* 35768 (BM); April–May 1918, *Ramos & Edano* 30840 (BM).

This species is unique in the possession of leaves with successive transverse rows of teeth projecting from the chlorophyllose lamina.

Syrrhobodon aristifolius Mitt. in *J. Linn. Soc. Bot.* **10**: 176 (1868).

Type: Samoa, Upolu, 1000–2000 ft, May 1867, *Powell* 89 (BM!-isotype).

Fig. 17.

Syrrhobodon subulatus Sande Lac. in *Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk.* **13**(2): 5 (1872). Type: Sulawesi ['Celebes'], ex Hb. *Sande Lac.* s.n. (BM!-isotypes?).

Syrrhobodon fallax Sande Lac. in *Verh. Kon. Ned. Akad. Wetensch. Amst., Afd. Natuurk.* **13**(2): 5 (1872). Type: Banca, *Kurz* s.n. (L-syntype); Borneo, *Korthals* s.n. (L-syntype).

Shoots mostly 1–2 cm high, in bristly tufts. Stems short, often matted with rhizoids. Leaves long, flexuous, hair-like, mostly (<5–) 7–20 mm long, erect to patent or subfalcate to variously flexed from a broadly subelliptical base with long sloping shoulders; apex aristate (Fig. 17a–d). Costa strong, above leaf shoulders occupying most of the leaf; gradually narrowing distally into an often long excurrent, fine, entire arista; superficial cells above leaf base quadrate to shortly rectangular, smooth and flat; internally with 1–2(–3) layers of guide cells between dorsal and ventral layers of stereids (Fig. 17h). Chlorophyllose lamina occupying leaf shoulders, merging proximally with the hyaline lamina; above leaf shoulders continuing linearly (seldom more than 5–6 cells wide on either side of the costa); beyond midleaf towards apex tapering into costa; unistratose but sometimes with bistratose patches; cells long to shortly rectangular or elliptical, isodiametric to longer than broad, smooth, sometimes slightly convex ventrally, mostly 10–20 × 7.5–12.5 µm (often more elongated in leaf shoulders, some reaching >30 µm long) (Fig. 17g). Hyaline lamina merging into chlorophyllose lamina below shoulders of leaf, not usually sharply defined (Fig. 17f). Leaf margins from above leaf shoulders towards apex formed by a polystratose rib (in some leaves continuing beyond distal limit of chlorophyllose lamina and becoming continuous with the costa), lacking stereids, superficial cells in surface view quadrate to shortly rectangular, smooth, some forming distant, often multicellular teeth;

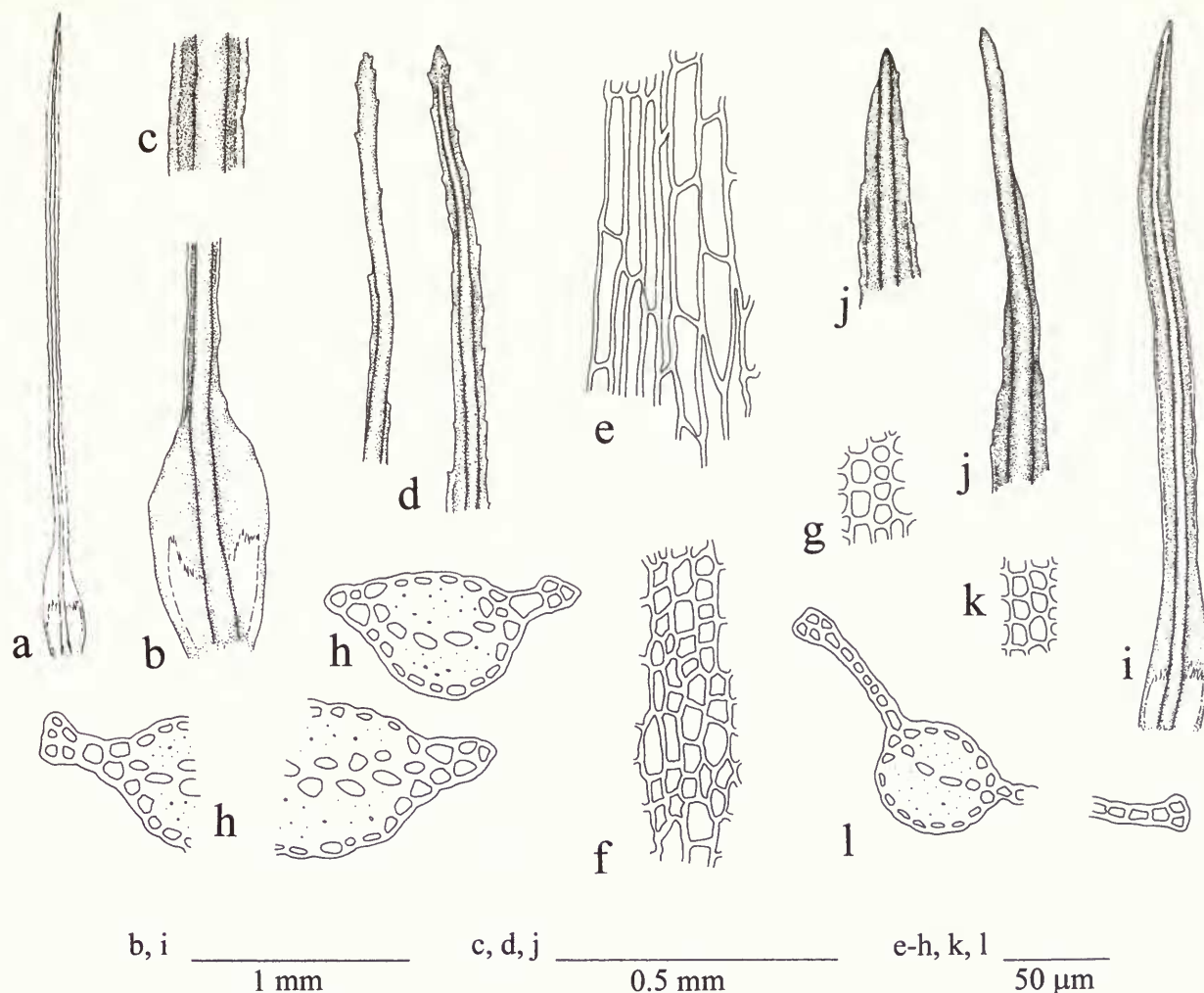


Fig. 17 a–h. *Syrrhodon aristifolius* Mitt. (typical form) a–d: leaf (a: semidiagrammatic representation, with details of b: hyaline base, c: mid-leaf, d: apices); e–g: cells of leaf in surface view (e: at margin of hyaline base, f: around apex of hyaline lamina, g: in chlorophyllose lamina); h: cross-section of leaf in chlorophyllose limb. i–l. *S. aristifolius* (short-leaved form) i, j: leaf (i: in ventral view, with j: detail of apices); k: chlorophyllose lamina in surface view, l: chlorophyllose limb in cross-section. a–h Drawn from Solomon Islands, *Lee* 803 (BM). i–l Drawn from Peninsular Malaysia, *Ellis* s.n. (BM).

around leaf shoulders unistratose, usually entire, rarely subdenticulate; in proximal leaf base unistratose, entire, composed of small hyaline cells, sometimes with walls thicker than those of adjacent hyaline cells (marginal band of linear thick-walled cells rarely apparent) (Fig. 17e). Seta c. 11 mm long; capsule c. 1.5 mm long; operculum with a long subulate beak.

HABITAT. On tree trunks in lowland rainforest.

DISTRIBUTION. An Indo-Pacific species. Bartram (1939) cites three Philippine collections (as *Syrrhodon fallax* Sande Lac. and *S. subulatum* Sande Lac.) from Mindoro and Mindanao.

No other local specimens examined.

As with most species in the Calymperaceae, plants of *Syrrhodon aristifolius* are highly plastic. An atypical, under-developed form, with leaves consistently <5–7 mm long (Fig. 17i), occurs in lowland tropical rainforest. This form is all but absent from herbaria, yet extensive populations have been sampled in Sabah and the Malayan Peninsula. It remains to be detected in the Philippines.

Superficially this form has some resemblance to *Calymperes subserratum*, but leaves in the latter possess unistratose margins and

much smaller cells in the chlorophyllose lamina (<5–10(–12.5) × 5–7.5 µm) which are ventrally protuberant. The leaves in *S. aristifolius* have polystratose margins and larger, mostly flat cells in the chlorophyllose lamina (10–20 × 7.5–12.5 µm).

***Syrrhodon armatus* Mitt.** in *J. Linn. Soc. Bot.* 7: 151 (1863).

Type: West Africa, Bagroo River, 1861, *Mann* s.n. (NY-syntype; BM!-isotype); West Africa, banks of the Nun, September 1860, *Mann* [549] (NY-syntype; BM!-isotype).

Fig. 19h–n.

Syrrhodon fimbriatus Müll. Hal. in *Linnaea* 37: 151 (1872), *hom. illeg.*

Syrrhodon fimbriatulus Müll. Hal. in *J. Mus. Godeffroy* 3(6): 52 (1874). Type: Australia, Brisbane River, 1864, *Dietrich* s.n. (B-holotype, presumably destroyed; isotypes not found, fide Reese & Bartlett (1982)).

Syrrhodon larminatii Broth. & Paris in *Rev. Bryol. Lichénol.* 28: 125 (1901). Type: Vietnam, Hanoi, Lao Cai, *Larminat* s.n. (H-BR-holotype).

Syrrhodon tsushimae Cardot in *Bull. Herb. Boissier* ser. 2, 7: 716

(1907). Type: Japan, *Faurie* 1637 (PC?-holotype).

Syrrhopodon philippinensis E.B. Bartram in *Philipp. J. Sci.* **68**: 83 (1939). Type: Philippines, Luzon, Zambales Prov., hills between San Marcelino and Mount Pinatubo, *Bartlett* 14219 (FH!-holotype).

Shoots 0.4–1 cm high, densely leaved, matted with rhizoids below, forming dense, yellowish green mats. Leaves 1–2(–3) mm long, linear, erect to patent (incurled-crisped when dry), consisting of a narrowly elliptical hyaline base tapering gradually into a chlorophyllose limb; leaf apex broadly obtuse to almost truncate, cuspidate (cusp sometimes dorsally inclined) (Fig. 19h, i). Costa (prominent dorsally) ending below apex in a blunt, dentate point; dorsally (usually from mid-hyaline base to apex) and ventrally (usually from above hyaline base to apex) with short to long, erect to distally-curving, acute spines. Chlorophyllose lamina laxly incurved, rarely slightly undulate; cells longer than broad to broader than long, with 4–6 sides or rounded-elliptical, 5–15 × 5–10 µm (Fig. 19j), ventrally and dorsally drawn out as single, often tall, sometimes curving, subacute projections (Fig. 19n). Hyaline lamina sharply defined. Leaf margins from proximal chlorophyllose limb to beyond midleaf (occasionally to near apex) usually consisting of a thin, largely entire strand of stereids (sometimes weak, intermittent or absent) (Fig. 19k); in hyaline base composed of a narrow, flattened strand of linear, thick-walled cells (<3–5 cells wide, usually continuous with marginal strand in distal leaf); adjacent to and beyond distal region of hyaline lamina giving rise to a row of acute spines and/or cilia (Fig. 19j). Gemmae sometimes produced from ventral surface of costal apex. Sporophytes rare. Seta *c.* 5–6 mm long; capsule cylindrical, *c.* 1 mm long; peristome teeth strongly papillose.

HABITAT. Corticolous

DISTRIBUTION. A Palaeotropical species. In the Philippines confined to Luzon Island.

Asian and Australasian plants of this species were previously referred to *Syrrhopodon fimbriatulus* Müll. Hal. Reese & Stone (1995) recognized this taxon to be conspecific with *Syrrhopodon armatus*, earlier described from Africa.

Syrrhopodon armatus is very similar to *Syrrhopodon trachyphyllus* Mont. The latter has slightly more robust shoots and leaves than *S. armatus* but the main distinguishing feature is the form of the chlorophyllose lamina. In *S. trachyphyllus* the cells of the chlorophyllose lamina are 10–15(–17.5) × 8–12.5 µm, each with a crown of papillae projecting from the dorsal and ventral surfaces (Fig. 24i). Those in *S. armatus* are 5–15 × 5–10 µm, with a single papilla projecting from the dorsal and ventral surfaces (Fig. 19n).

Syrrhopodon ciliatus (Hook.) Schwägr., *Sp. musc. frond. suppl.* **2**(1): 114, 130 (1824).

Fig. 16g–i.

Weissia ciliata Hook., *Musci Exot.* **2**: 7, 171 (1820). Type: Ternate Island, Hb. Dickson (BM!-holotype?; BM!-isotype).

Shoots mostly <0.5–1(–4) cm high, soft, pale green, often densely covered with red rhizoids below. Leaves delicate, suberect to reflexed, <1–2.5(–3) mm, lingulate, ending in an obtuse, apiculate apex, hyaline lamina often exceeding half of the total leaf length (Fig. 16g). Costa thin, ending in the apiculus, superficially smooth apart from occasional long cilia projecting from the ventral surface, internally a single row of guide cells between dorsal and ventral rows of stereids. Chlorophyllose lamina in distal leaf often laxly infolded, sometimes slightly undulate; cells 8–12.5 × 8–17.5(–20) µm, with smooth, flat surfaces (Fig. 16h). Leaf margin in hyaline

base formed by a flattened band of long, narrow thick-walled cells; distally, slightly narrowing but continuing to near the leaf apex; above mid-hyaline lamina giving rise at distant intervals to long cilia (sometimes exceeding 200 µm in length).

Modified gemmiferous leaves occasionally present, usually 1–2 per shoot; linear and tubular, sometimes exceeding 4 mm long. Costa thick, occupying most of leaf; at apex expanding slightly to form a broad, blunt tip from which the gemmae are produced. Lamina present but very narrow throughout, involute. Marginal rib bearing short cilia. Sporophytes not uncommon. Seta red, *c.* 4–5 mm long; capsule reddish light brown, shortly cylindrical, *c.* 0.75–1 mm long; operculum with a long, subulate beak; peristome teeth red, papillose.

HABITAT. On trees at low altitudes.

DISTRIBUTION. An Indo-Pacific species, uncommon in the Philippines.

SPECIMEN EXAMINED. **Mindanao**, March 1896, *Micholitz* 165 (BM, BM-K).

Syrrhopodon confertus Sande Lac. in *Verh. Kon. Ned. Akad. Wetensch. Afd. Natuurk* **13**: 4 (1872). Type: Banca, Kurz s.n. (Lectotype).

Fig. 18k–p.

Syrrhopodon amoenus Broth. in *Oefvers. Förh. Finska Vetensk.-Soc.* **42**: 94 (1900). Type: New Guinea, 1897, *Musgrave* s.n. (BM!-isotypes).

Shoots <0.5–>2.5 cm, densely leaved, forming pale, dense mats and cushions. Leaves erect to patent, lanceolate, 1.5–3 mm long, consisting of a short, linear-lanceolate chlorophyllose limb extending from a narrowly suboblong hyaline base (usually occupying over half the leaf length); leaf apex usually drawn out into a fine, denticulate, acute point (Fig. 18k, l). Costa narrow (especially in leaf base), ending in apex to excurrent; superficial cells long and narrow, ventral surface smooth, dorsal surface above hyaline base smooth to spinose (spines most frequently arising from cells adjacent to lamina); internally (above base) consisting of a layer of guide cells (2–3 cells wide) separating dorsal and ventral bands of stereids. Lamina at leaf shoulders often recurved. Cells of chlorophyllose lamina obscured on ventral and dorsal surfaces of leaf by tall projections crowned with compound papillae. Hyaline lamina often occupying up to two thirds of leaf length, sharply defined but narrowly tapering into the chlorophyllose limb between the costa and the narrow wings of the proximal chlorophyllose lamina (Fig. 18m). Leaf margins from shoulders to near leaf apex composed of stereids or substereids in a thin, polystratose rib, at shoulders notched to denticulate, above denticulate with single or double teeth; from below shoulders to leaf base entire, consisting of a flattened, narrow band of thick-walled, linear cells. Sporophytes rare, not seen in Philippine material.

HABITAT. On tree trunks in lowland rainforest.

DISTRIBUTION. An Indo-Pacific species. Bartram (1939) cites Philippine specimens from Luzon, Negros and Panay (as *Syrrhopodon amoenus* Broth.).

SPECIMEN EXAMINED. **Luzon**, Isabela Province, San Mariano, Barrio Disulap, Dimahahabong Creek, 14 April 1991, *Tan* 91–140 pro parte (FH).

The leaves of *Syrrhopodon confertus* are distinguishable from those of related species, such as *S. involutus* Schwägr. and *S. rufescens* Hook. & Grev., by the possession of a short but well-defined chlorophyllose limb. In the latter two species, the chlorophyllose

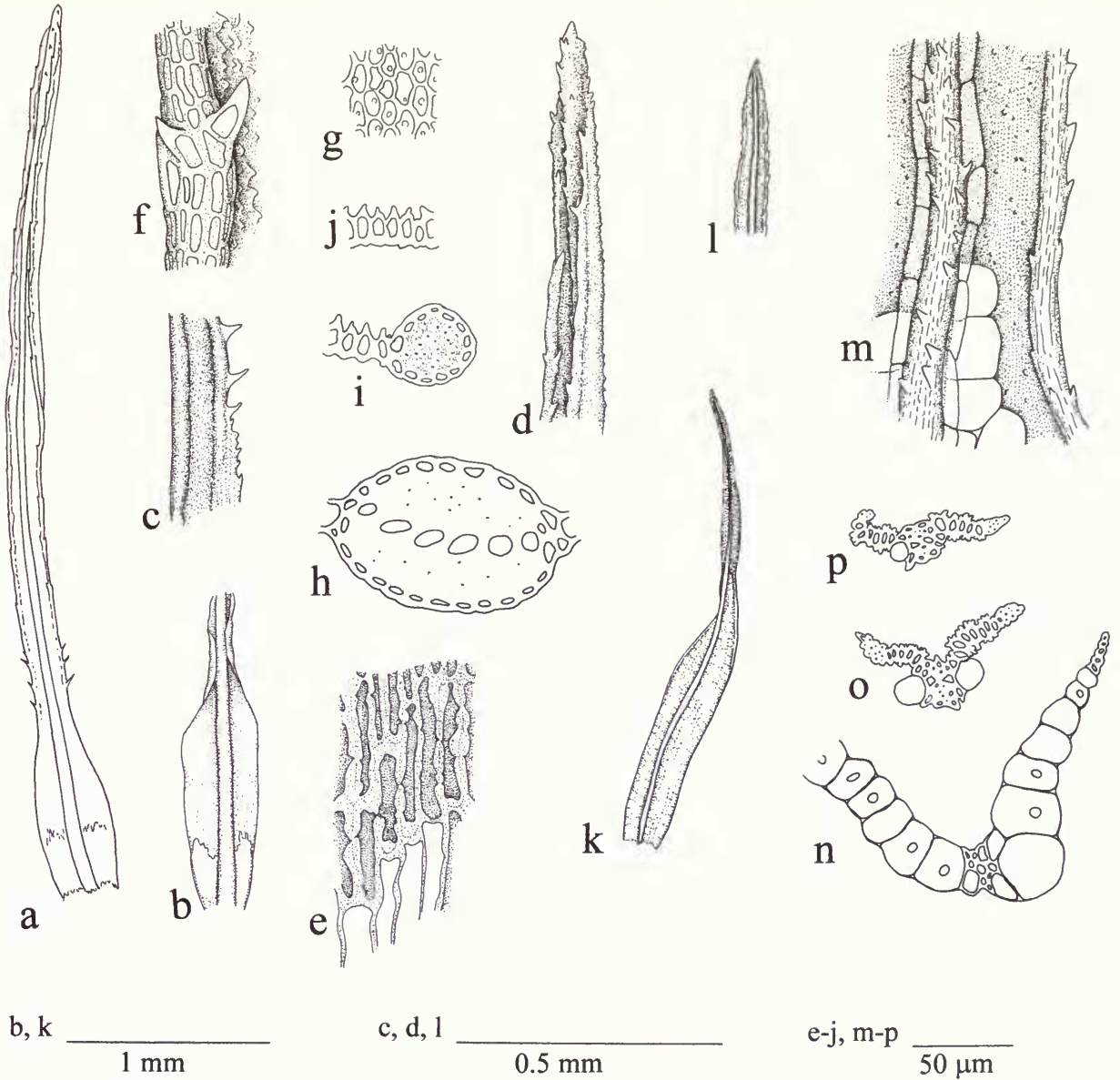


Fig. 18 a–j. *Syrrhopodon croceus* Mitt. a–d leaf (a: diagram of whole leaf, with details of b: base, c: region above base, d: apex); e–g: cells of leaf in surface view (e: above hyaline lamina, f: at margin in chlorophyllose limb, g: in chlorophyllose lamina); h–j cross-sections of leaf (h: costa, i: marginal rib in chlorophyllose limb, j: chlorophyllose lamina). k–p. *Syrrhopodon confertus* Sande Lac. k–l: leaf (k: in dorsal view, with details of l: apex in ventral view, m: apex of hyaline lamina in dorsal view); n–p: cross-sections of leaf (n: near base, o: above mid-leaf, p: near apex). a–j Drawn from *Tan* 92–173 (BM). k, m Drawn from Peninsular Malaysia, *Burkill* 2112 (BM). l, n–p Drawn from Sabah, *Ellis* 143–366 (BM).

lamina is confined to the apex of shortly pointed leaves, otherwise composed of hyaline cells.

Syrrhopodon croceus Mitt. in *J. Linn. Soc. Bot. Suppl.* **1**: 41 (1859).

Fig. 18a–j.

Calymperidium croceum (Mitt.) M. Fleisch., *Musc. Fl. Buitenzorg* **1**: 219 (1904). Type: Singapore, *Wallich* s.n. [3640] (BM!-isosyntype).

Shoots in dark green to reddish brown tufts, 2–5 cm high, often densely matted with rhizoids below. Leaves <5–10 mm long, stiff, straight or slightly curving, with an erect, elliptical semisheathing

base narrowing gradually into an erect to patent, linear-ligulate chlorophyllose limb, ending in a blunt, denticulate apex (Fig. 18a, b, d). Costa ending just below leaf apex to excurrent (tip dentate and often, especially in gemmiferous leaves, slightly expanded), in distal leaf-limb scabrid on both dorsal and ventral surfaces, proximally becoming smooth. Hyaline lamina clearly defined, usually confined to the lowermost third to half of leaf base, hyalocysts often yellow tinged; distal leaf base occupied by bright orange-red, incrassate, long rectangular to linear, porose cells (Fig. 18e); distally these becoming smaller and paler, gradually merging into the chlorophyllose lamina of the lower leaf-limb. Chlorophyllose lamina often incurved to near leaf apex, composed of shortly subrectangular to subelliptical cells with walls sometimes thickened at the angles,

mostly 10–20 × 7.5–10 mm, each projecting acutely from the ventral leaf surface (usually terminating in a sharp papilla), dorsally unipapillose (Fig. 18g, j). Margins of leaf base entire, adjacent to hyaline lamina formed by a broad, flat, orange-red band of incrassate, porose, linear cells (sometimes cells in outermost row of band shortly rectangular, thin-walled and hyaline); distally becoming indistinct, merging with the upper basal lamina; around and shortly above shoulders of leaf becoming clearly defined once more, composed of shortly to long subrectangular, incrassate cells in 5–8 rows, some in marginal row giving rise to long, acute teeth (Fig. 18c); from above shoulders to near leaf apex becoming a thick, polystratose rib composed of stereids with a broken superficial layer of shortly rectangular cells, some forming distant, large, single or double (sometimes triple) teeth (Fig. 18f, i). Gemmae sometimes produced from the ventral surface of the costal apex. Seta 12–17.5 mm long; capsule cylindrical, 1.5–<2 mm long.

HABITAT. On logs, tree trunks, and limestone rock in shade.

DISTRIBUTION. An Indo-Pacific species, very common in the Philippines.

SPECIMENS EXAMINED. **Basilan**, *Semper* s.n. (in Hb. Hampe, BM). **Leyte**, Baybay, Mt Pangasugan, 21–22 May 1984, *Tan, Navarez & Raros* 84–235 (BM). **Luzon**, Isabel Province, San Mariano, Sierra Madre Range, Barrio Disulap, Dimahabong Creek, 14 April 1991, *Tan* 91–140 pro parte (FH); *ibid*, Sitio Digoyo, 17 April 1991, *Tan* 91–170 (BM); Palanan Wilderness, 21 May 1992, *Tan* 92–173 (BM); Laguna Province, Cavinti, Bo. Lumot, Ubali River, near Sitio Ubali, 24 October 1982, *Tan & Tandang* 82–376 (FH); Quezon Province, Real, National Botanical Garden, 24 December 1981, *Tan* 81–446 (Musc. Philipp. Fasc. 2 no. 29) (BM). **Palawan**, Puerto Princesa, Barangay Irawan, Mt Malinao, 4 May 1993, *Tan* 93–308 (FH). **Sibuyan**, Magdiwang, Barangay Tampayan, Mt Giting-Giting, 1 May 1987, *Tan & Hernaez* 87–473 (BM); *ibid*, 21 May 1987, *Tan & Hernaez* 87–445 (BM).

This species is highly variable. There are many atypical forms in which the leaves may be very short and in which distinctive features, such as the orange-red cells in the distal leaf base or the teeth along the margin of the lower leaf limb, may be obscure or completely missing.

Syrrhopodon flammeonervis Müll. Hal. in *Linnaea* 38: 557 (1874).

Type: Philippines, Luzon, 1871, *Wallis* s.n. (FH!, H-isotypes). Fig. 19a–g.

Syrrhopodon flammeonervis var. *robustus* Dixon in *J. Linn. Soc. Bot.* 50: 81 (1935). Type: Sarawak, Ulu Tinjar, Sungei Balapau, G. Laiun, c. 1100 m, 2 November 1932, *Oxford Expedition* [Richards] 2381 (BM!-holotype).

Shoots 2–>6 cm high, in pale to dull green tufts. Leaves 3–>6 mm long, consisting of an erect, clasping, narrowly oblong hyaline base abruptly narrowing into an erect to spreading, linear chlorophyllose limb that is 'v'-shaped in cross-section (loosely and irregularly curved and twisted when dry); apex blunt, dentate (Fig. 19a, b). Costa ending immediately below apex; towards and at apex dorsal surface with large, acute teeth, proximally cells in rows adjacent to the lamina sometimes forming acute to spinose teeth, otherwise smooth (dorsal and ventral surfaces largely composed of stereids). Chlorophyllose lamina at leaf apex forming a narrow, spinose margin around the costal apex, ultimate cell often in the form of a large, dorsally slanting, spinose tooth (Fig. 19b); below apex cells isodiametric to longer than broad, with 4–6 sides or irregularly rounded-elliptical, 8–17(–25) × 7.5–10(–12.5) μm (Fig. 19e), dorsally and ventrally drawn out into coronate-papillose projections (towards leaf apex projections sometimes becoming more spinose) (Fig. 19f). Hyaline lamina sharply defined. Leaf margin sometimes

incurved above and/or recurved at leaf shoulders; from around apex of leaf shoulders to near leaf apex formed by a thick strand of stereids (Fig. 19g), largely entire but near apex some superficial cells forming teeth; from shoulders to leaf base composed of a flattened band (continuous with rib in upper leaf) of thick-walled, linear cells in about 3–7 rows (sometimes cells of outermost row with thin walls) (Fig. 19d); in shoulders uneven to denticulate, below shoulders entire. Sporophytes not seen.

HABITAT. Eddy (1990) reports this species as occurring 'on bark and acidic rocks in moist rainforest between 1000 and 2000 m alt.'

DISTRIBUTION. SW China, Indochina, Philippines, Borneo. In the Philippines known from the islands of Luzon, Palawan and Negros.

SPECIMENS EXAMINED. **Luzon**, Mt Makiling, 16 August 1931, *Herklots* P18b (BM). **Palawan**, Mt Manalsal, May 1929, *Edano* 80869 (BM).

Syrrhopodon gardneri (Hook.) Schwägr., *Sp. musc. frond. suppl.* 2(1): 110 (1824).

Fig. 20i–u.

Calymperes gardneri Hook., *Musci Exot.* 2:146 (1819). Type: Nepal, *Gardner* [1205] (BM!-holotype, BM!-isotype).

Syrrhopodon curranii Broth. in *Philipp. J. Sci. C.* 5: 142 (1910). Type: Philippines, Luzon Island, Benguet Province, December 1908, *H.M. Curran* 15636 (BM!-isotype).

Shoots 0.5–>5 cm high. *Leaves* mostly 3–5 mm long, erect to patent, narrowly to broadly linear-ligulate from an erect, elliptical hyaline base; ending in an obtusely pointed, denticulate apex (Fig. 20i–k). Costa ending just short of leaf apex in a dentate tip; in upper leaf many superficial cells forming acute, forward-pointing teeth, often with one or two small papillae; especially towards leaf apex distant, subtransverse rows of relatively larger teeth sometimes occur (Fig. 20q). Chlorophyllose lamina often broadly incurved to below leaf apex; cells quadrate to shortly rectangular or subelliptical (mostly isodiametric or longer than broad), 7–17.5(–20) × 7–10 μm (Fig. 20p), projecting acutely from the ventral leaf surface, each projection bearing one or more small papillae, dorsally uni- or pleuri-papillose (Fig. 20t, u). Hyaline lamina well-defined (Fig. 20l). Marginal ribs in proximal leaf base entire to dentate, flat, composed of long, narrow, thick-walled cells (Fig. 20m); in distal leaf base vanishing into chlorophyllose lamina; from around mid-hyaline base to above shoulders rib lacking, margin denticulate to subciliate (Fig. 20n); above shoulders polystratose, erect or incurved, composed of quadrate to shortly rectangular cells (stereids absent), double or single teeth occurring at intervals along the margin (Fig. 20o). Gemmae sometimes produced from the ventral surface of the costal apex. Seta dull orange, 4–5 mm long; capsule cylindrical, 1–1.3 mm long.

HABITAT. On tree trunks in rainforest. Most frequent at 1000–2000 m, occurring at higher altitudes than many taxa in the Calymperaceae.

DISTRIBUTION. A nearly pantropical species. In the Philippines confined to Luzon.

SPECIMEN EXAMINED. **Luzon**, Benguet Province, Buguias, Lake Tabayog, 25 October 1985, *Tan & Hernaez* 85–127 (BM, FH).

The leaves of *Syrrhopodon gardneri* are superficially similar to those of *S. japonicus* (Besch.) Broth. but are usually shorter. In most specimens of *S. gardneri* the leaves seldom exceed 5 mm long, the cells of the chlorophyllose lamina project acutely from the ventral leaf surface and dorsally and ventrally are usually papillose

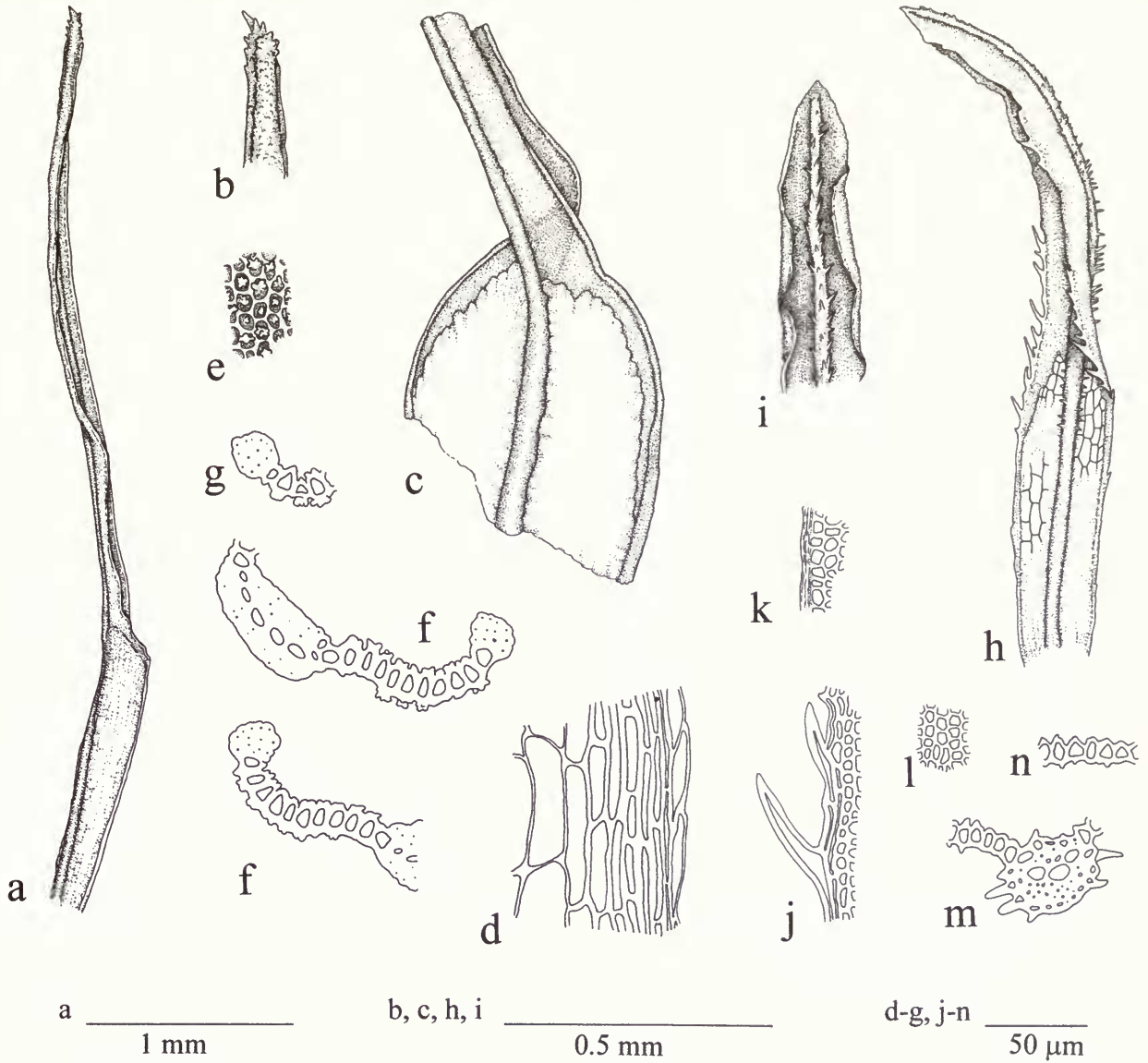


Fig. 19 a–g. *Syrrhopodon flammeonervis* Müll. Hal. a–c leaf (a: lateral view, with details of b: apex, and c: distal hyaline base); d, e: cells of leaf in surface view (d: at margin in mid-hyaline base, e: in chlorophyllose lamina); f–g: cross-sections of leaf (f: chlorophyllose limb, g: margin of chlorophyllose limb). h–n. *Syrrhopodon armatus* Mitt. h, i: leaf (h: ventral view, with detail of i: distal chlorophyllose limb in ventral view); j–l: cells of leaf in surface view (j at margin in distal hyaline base, k: at margin in mid-chlorophyllose limb, l: in chlorophyllose lamina (dorsal view)); m, n: cross-sections of leaf (m: costa, n: chlorophyllose lamina). a–g Drawn from *Edano* 80869 (BM). h–n Drawn from North Borneo, *Binstead* 35 (BM).

(Fig. 20t, u). In most specimens of *S. japonicus* the leaves are up to 7–8 mm long, the cells of the chlorophyllose lamina lack papillae and are more roundly protuberant (Fig. 21n), often with the greater protuberance from the ventral leaf surface.

Syrrhopodon hispidissimus Dixon in *J. Malayan Branch Roy. Asiat. Soc.* 6: 23 (1928). Type: Sumatra, Siberoet Island, September 1924, *Boden Kloss* 10581b (BM!-holotype).

Fig. 20a–g.

Syrrhopodon perarmatus E.B. Bartram in *Farlowia* 1: 42 (1943), *hom. illeg.* (non *S. perarmatus* Broth.).

Syrrhopodon hispido-ciliatus E.B. Bartram in *Farlowia* 1: 504

(1944). Type: Papua New Guinea, Palmer River, 2 miles below junction, Black River, July 1936, *Brass* 7161a (FH!-holotype).

Shoots delicate, <0.3–1.5 cm high, forming pale green, soft mats or tufts. Leaves consisting of a linear, erect to patent chlorophyllose limb narrowing from a suberect, subelliptical hyaline base, <1.5–3 mm long; apex subacute to acute, dentate (Fig. 20a–c). Costa ending below apex; dorsal and ventral surfaces above hyaline base with close-set, transverse-oblique rows of long, acute, distally leaning, unicellular spines (may exceed 35 µm long) (Fig. 20g); internally with a single row of guide cells. Chlorophyllose lamina <5–c.10 cells wide on either side of costa; cells mostly isodiametric to slightly longer than broad, 5–12.5 × 5–7 µm; each with a thick, often

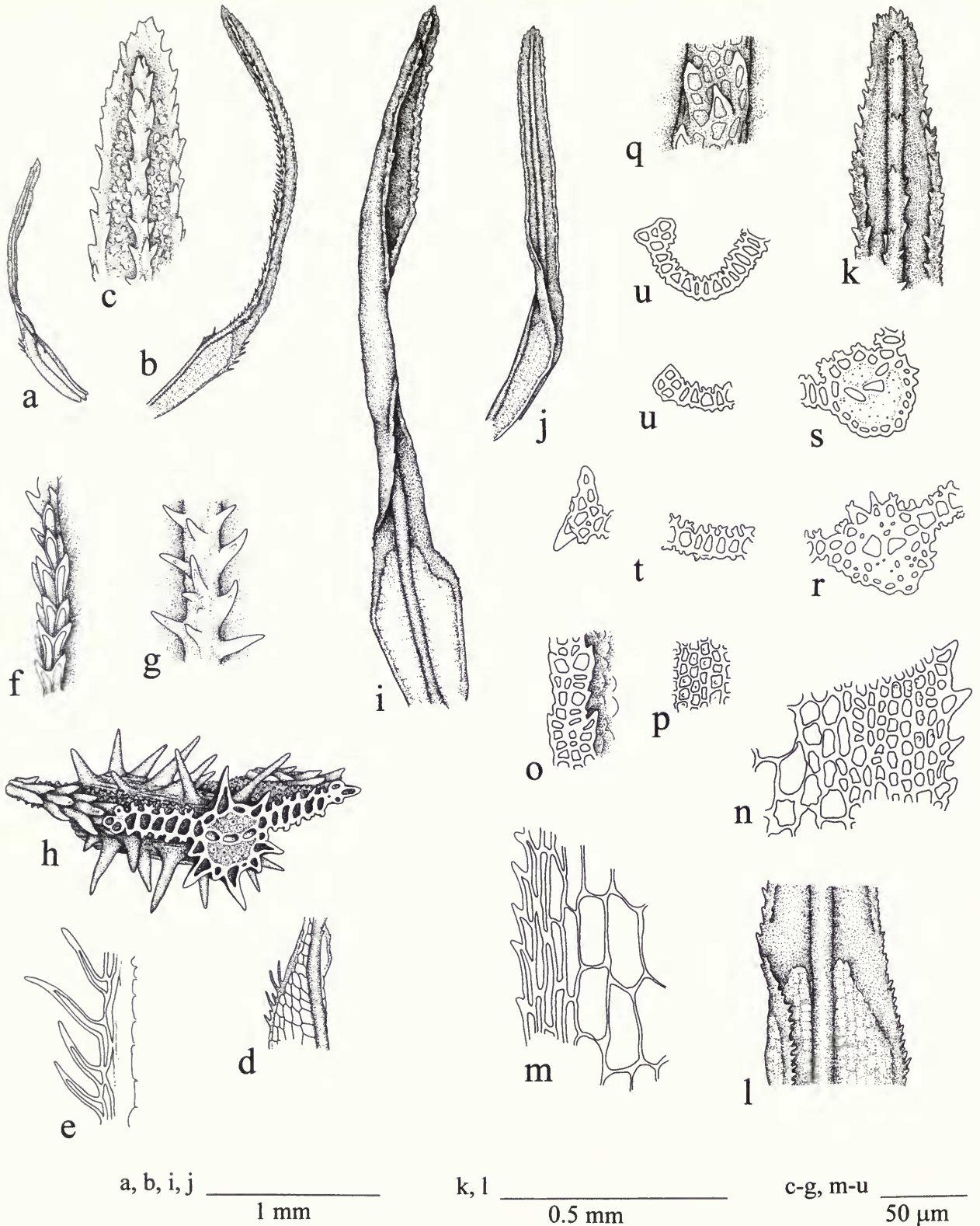


Fig. 20 a–h. *Syrrhopodon hispidissimus* Dixon a, b leaves, with details of c: apex, and d: region around apex of hyaline lamina; e–g: cells of leaf in surface view (e: at margin of distal hyaline base, f: at margin of chlorophyllose limb, and g: in costa); h: diagrammatic cross-section of leaf through chlorophyllose limb. i–u. *Syrrhopodon gardneri* (Hook.) Schwägr. i–l: leaves (i, j in ventral view, with details of k: apex (ventral view), and l: distal region of hyaline lamina); m–q: cells of leaf in surface view (m: at margin of hyaline lamina, n: at margin adjacent to apex of hyaline lamina, o: at margin in chlorophyllose limb (ventral view), p: of chlorophyllose lamina, q: of costa (ventral view)); r–u: cross-sections of leaf (r, s: costa, t, u: chlorophyllose lamina). a, c, d Drawn from *Ebalo 737* (FH). b Drawn from Sumatra, *Boden Kloss 10581b* (BM). e, f, g Drawn from Papua New Guinea, *Brass 7161a* (FH). i, k, m, r, t Drawn from *Tan & Hernaez 85–127* (BM). j, l, n–q, s, u Drawn from *Curran 15636* (BM).

tall crown of papillae protruding from the dorsal and ventral surfaces (in surface view papillae obscuring the shape of the underlying cells). Leaf margins from above shoulders of leaf to near apex formed by a thin polystratose rib of transversely aligned, long, narrow cells that are drawn out distally as acute, forward pointing teeth (in transverse ranks of 2–4) (Fig. 20f); from shoulders to leaf base consisting of a flattened band of long, narrow, thick-walled cells (continuous with rib of upper leaf), at shoulders producing a row of cilia (cilia often exceeding 80 μm long) (Fig. 20e), entire below. Sporophyte unknown.

HABITAT. On exposed roots, tree trunks and buttresses in shaded situations.

DISTRIBUTION. An uncommon Indo-Pacific species. In the Philippines the species has been found in Mindanao and probably also occurs in Luzon.

SPECIMEN EXAMINED. **Mindanao**, Zamboanga Province, Muralong Mountain near Kabasalan, 27 November 1940, *Ebalo* 737 (FH).

Syrrhopodon hispidissimus is sometimes confused with *S. spiculosus*. In the latter, the margin of the leaf above the hyaline base is formed (except near the leaf apex) by a rib of stereids which is smooth and entire (Fig. 23h); in *S. hispidissimus* most cells at the surface of the marginal rib give rise to sharp, distally-pointing teeth (Fig. 20f).

Syrrhopodon involutus Schwägr., *Sp. musc. frond. suppl.* 2(1): 117 (1824). Type: Moluccas, Rawak Island, *Gaudichaud* 11 (26) (BM!-isotype).

Fig. 21a–g.

Syrrhopodon revolutus Dozy & Molk. in *Ann. Sci. Nat. Bot. sér.* 3, 2: 315 (1844). Type: Java and Borneo, *Korthals* s.n. (L-holotype; BM!-isotype).

Trachymitrium borneense Hampe in *Nuovo Giorn. Bot. Ital.* 4: 280 (1872). Type: Borneo, Sarawak, *Beccari* 46 (BM!-holotype).

Syrrhopodon borneensis (Hampe) A. Jaeger, *Gen. Sp. musc.* 1: 316 (1873).

Leucophanella borneense (Hampe) M. Fleisch., *Musc. Fl. Buitenzorg* 1: 197 (1904).

Leucophanella revoluta (Dozy & Molk.) M. Fleisch., *Musc. Fl. Buitenzorg* 1: 198 (1904).

Shoots 1–2(–>3) cm high, freely branched, densely leaved, in densely packed, pale green cushions, often loosely matted with red rhizoids below. Leaves 1–1.5 mm long, erect to erecto-patent, lanceolate, above often involute or 'v'-shaped in cross-section; leaf apex obtuse to shortly pointed, entire to denticulate; largely composed of hyaline lamina (Fig. 21a, b). Costa thin, ending in or just below apex; dorsal surface smooth below, nearing leaf apex often scabrid, teeth mostly formed by cells in rows adjacent to the lamina; ventral surface smooth, rarely toothed near apex; internal structure similar to that in *Syrrhopodon confertus*, consisting of a layer of guide cells (2–3 cells wide) separating dorsal and ventral bands of stereids (ventral band sometimes poorly developed) (Fig. 21d–f). Chlorophyllose lamina occupying leaf apex, proximally narrowly tapering down either side of the hyaline lamina, ceasing prior to midleaf; cells mostly quadrate to shortly rectangular, or irregularly rounded-elliptical, mostly 5–>15 \times 5–>10 μm (Fig. 21c); dorsally and/or ventrally flat or protruding subacutely, smooth or unipapillose (Fig. 21e, g). Hyaline lamina occupying about two thirds to more than four fifths of the leaf length, sharply defined; cells large, thin-walled, shortly subrectangular, seldom in more than about 5–6 rows on either side of the costa. Leaf margins often recurved above; from

leaf base to near apex entire, consisting of a narrow, smooth, unistratose to bistratose strand of stereids (Fig. 21c, d, e). Seta red, smooth, <6–>10 mm long; capsule erect, shortly cylindrical, <1 mm long, yellowish brown with a red rim, lid long rostrate, reddish brown; peristome teeth <100–>150 μm long, papillose.

HABITAT. On trunks and exposed roots of trees and decaying logs.

DISTRIBUTION. A palaeotropical species. Common in the Philippines.

SPECIMENS EXAMINED. **Catanduanes**, 14 November–1 December 1917, *Ramos* 30610 (BM, BM-K); **Luzon**, *Loher* 1056 (BM-K); Baguio, 1910, *Sanchez* 6 (BM); Benguet, *Micholitz* 153 (BM-K); Laguna, San Antonio, *Ramos* 16672 (BM). **Mindanao**, March 1896, *Micholitz* 179 (BM, BM-K); Agusan Norte, Cabadbaran, Mt Hilog-Hilong, 31 May–2 June 1984, *Tan & Navarez* 84–492 (FH). **Mindoro**, between Bongabon and Pinamalayan, 5 February–5 April 1941, *Maliwanag* 313 (FH).

Syrrhopodon japonicus (Besch.) Broth., *Nat. Pflanzenfam.* 2nd ed., 10: 233 (1924).

Fig. 21h–o.

Calymperes japonicus Besch. in *J. Bot. (Morot)* 12: 296 (1898).

Type: Japan, Nagasaki, March 1895, *Faurie* 15454 (BM!-holotype).

Calymperes datense E.B. Bartram in *Philipp. J. Sci.* 68: 98 (1939).

Type: Philippines, Luzon, Benguet subprovince, Mount Data, 8000 ft, *Hadden* 116 (FH!-lectotype, fide Mohamed & Reese, 1985).

Shoots <2–5(–6) cm high, often matted with red rhizoids below. Leaves 7–8(–9) mm long, linear-lanceolate, bristle-like, patent to recurved from an erect, narrowly elliptical hyaline base (shoulders of leaf often not very pronounced), at apex tapering to an acute, dentate tip (Fig. 21h, i). Costa strong, excurrent, sometimes long-excurrent; superficial cells mostly flat and smooth but often forming teeth near costal apex; internally with a single row of guide cells between dorsal and ventral bands of stereids (Fig. 21m). Cells of chlorophyllose lamina quadrate to subrectangular, mostly 1–3 times longer than broad, 6–12.5(–15) \times 5–8 μm (Fig. 21l), projecting roundly to subacutely from the ventral leaf surface, dorsally flat to slightly protuberant, smooth (Fig. 21n); around leaf shoulders usually grading gradually into areas of larger, subquadrate to subrectangular incrassate cells (often with transverse walls and corners preferentially thickened) that grade proximally into the large, thinner walled cells of the hyaline lamina in the leaf base (sometimes hyaline cells thick-walled to base of leaf) (Fig. 21j). Margins from above shoulders to near leaf apex formed by a polystratose rib (sometimes weak), superficial cells subquadrate to rounded, double (sometimes triple) teeth occurring at short intervals, lacking stereids (Fig. 21k, o); in shoulders and upper leaf base unistratose and undifferentiated, denticulate; in proximal leaf base usually entire, formed by a flattened rib composed of long, narrow thick-walled cells (cells in marginal row often with slightly thinner walls than those in inner rows), vanishing distally. Sporophytes apparently rare, not seen in Philippine material. Seta *c.* 15 mm long; capsule 1.5–2 mm long.

HABITAT. In montane rainforest; on tree trunks, buttresses, moist humus and logs, usually in shade.

DISTRIBUTION. Japan, China, Indo-China, Malesia. Widespread in the Philippines.

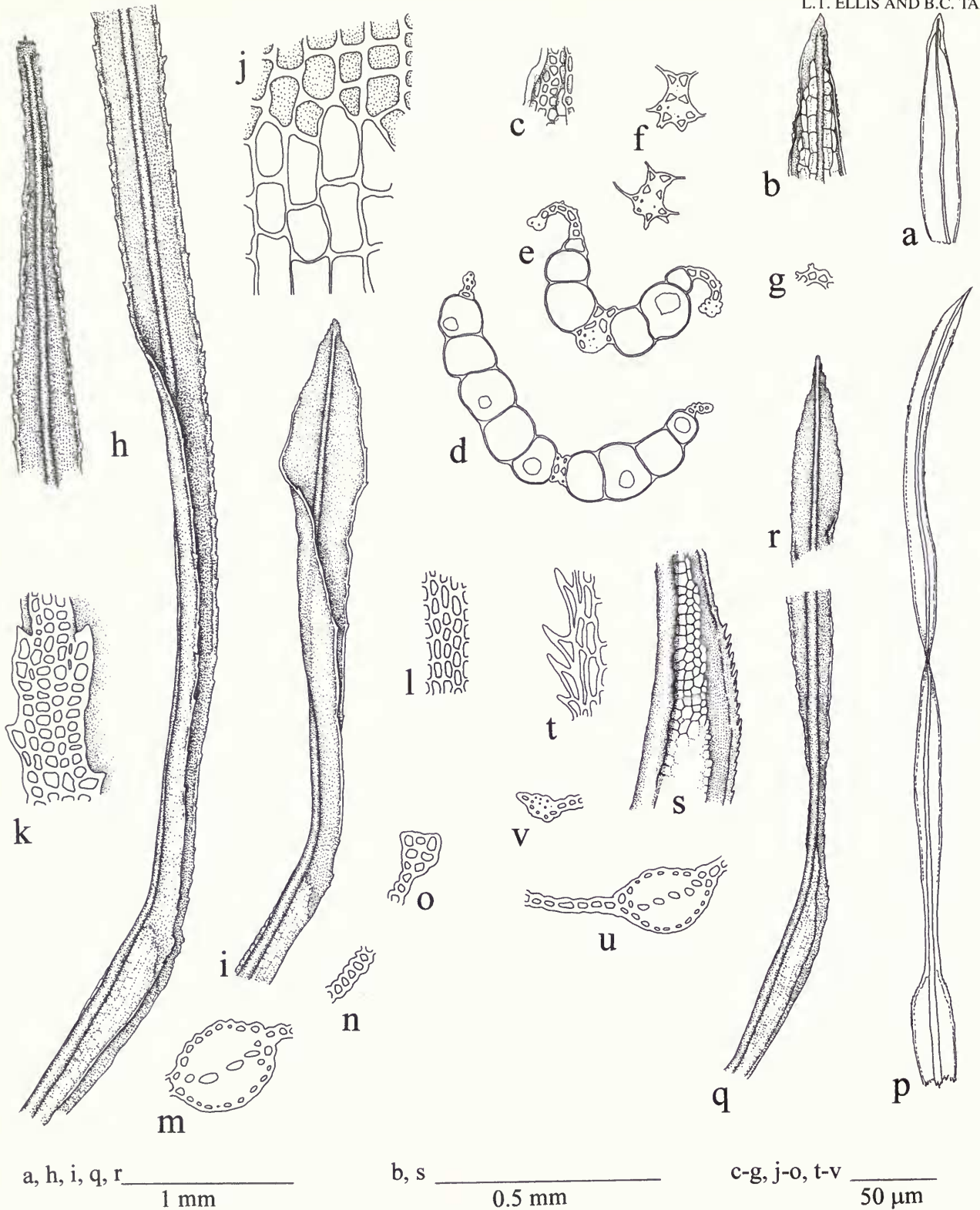


Fig. 21 a–g. *Syrrhopodon involutus* Schwägr. a: leaf, with b: detail of apex in ventral view; c: cells of chlorophyllose lamina above hyaline lamina; d–g: cross-sections of leaf (d: near base of leaf, e: above mid-leaf, f: costa near apex, g: chlorophyllose lamina). h–o. *Syrrhopodon japonicus* (Besch.) Broth. h, i: leaves; j–l: cells of leaf in surface view (j: around apex of hyaline lamina, k: at margin in mid-leaf, l: in chlorophyllose lamina); m–o: cross-sections of leaf (m: costa, n: chlorophyllose lamina, o: marginal rib in chlorophyllose limb). p–v. *Syrrhopodon loreus* (Sande Lac.) W.D. Reese p–s: leaf (p: diagram of whole leaf, with details of q; hyaline base and proximal chlorophyllose limb, r: apex, and s: distal hyaline base); t: cells at margin of leaf adjacent to apex of hyaline lamina; u, v: cross-sections of leaf (u: costa and chlorophyllose lamina, v: marginal rib in chlorophyllose limb). a–g Drawn from Tan & Navarez 84–492 (FH). h Drawn from Tan, Navarez & Amoroso 84–365 (BM). i, m–o Drawn from Gruezo 5798 (FH). j–l Drawn from Hadden s.n. (FH). p–t Drawn from Tan 91–108 pro parte (FH). u, v Drawn from Tan & Wijengco 85–105 pro parte (BM).

SPECIMENS EXAMINED. **Mindanao**, Bukidnon Province, trail to summit of Mt Kitanglad, 25–27 May 1984, *Tan, Navarez & Amoroso* 84–365 (BM, FH). **Negros**, Cuerno de Negros, 28 January 1937, *Magdamo* 1 (FH); *Magdamo* 12 (FH). **Palawan**, Mt Mantalingahan Range, Padparan, trail to Mt Inang Baboy Peak, 27 April 1979, *Gruezo* 5798 (FH).

Syrrhodon loreus (Sande Lac.) W.D. Reese in *Phytologia* **56**: 306 (1984).

Fig. 21p–v.

Calymperes loreum Sande Lac. in *Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk.* **13**(2): 7 (1873). Type: Borneo, Labuan, *Motley* s.n. (L-holotype).

Calymperes setifolium Hampe in Besch. in *Ann. Sci. Nat. Bot.* sér. 8, **1**: 304 (1895). Type: Philippines, Basilan, *Semper* s.n. (BM!-holotype).

Calymperes ebaloi E.B. Bartram in *Farlowia* **1**: 505 (1944). Type: Philippines, Zamboanga Prov., Mindanao, Lilimbrog Mountain, near Kabasalan, *Ebaloi* 664 (FH!-holotype).

Shoots 3–5 cm high, with a short, obscure stem. Leaves 6–>30(–>40) mm long, hair-like, erect, falcate or variously curving from a narrowly elliptical hyaline base; chlorophyllose limb notably constricted for a short distance above hyaline base; towards apex tapering to a long, fine, denticulate tip (Fig. 21p–s). Costa strong, excurrent or ending in leaf apex, largely smooth but often sparsely toothed near apex, superficial cells shortly rectangular, internally guide cells forming a single row between dorsal and ventral bands of stereids (Fig. 21u). Chlorophyllose lamina narrow, often undulate; from shoulders of leaf tapering proximally into the leaf base along either side of the hyaline lamina and gradually merging into the broad marginal ribs in the lower part of the leaf base; around shoulders of leaf cells towards margins slightly elongated, with the marginal row forming teeth or short spines (Fig. 21s, t); distally, from shoulders of leaf tapering or abruptly narrowing, virtually disappearing into costa, then broadening gradually above into long, linear limb (constricted region of lamina sometimes exceeding twice the length of the leaf base); towards apex tapering into the long, fine leaf tip; cells subquadrate to shortly rectangular (mostly longer than broad) or rounded, 5–15(–17) × 5–10(–12.5) μm, dorsally flat and smooth, ventrally flat to roundly protuberant (Fig. 21u). Hyaline lamina usually well-defined. Marginal ribs in proximal leaf base broad and flat, entire, composed of long, narrow, thick-walled cells, vanishing distally into chlorophyllose lamina; absent around leaf shoulders and below region of constricted lamina; above constriction narrow, polystratose, composed largely of a band of stereids adjacent to longitudinal rows of shortly to long rectangular chlorophyllose cells (sometimes forming a partial layer around the band of stereids) (Fig. 21g); some chlorophyllose cells forming large distant teeth, towards the leaf apex teeth becoming more closely set and sometimes double. Sporophytes reddish brown; seta 12–13 mm long; capsule 1.5–<2 mm long.

HABITAT. Mostly occurring on tree trunks in lowland rainforest.

DISTRIBUTION. An Indo-Pacific species. In the Philippines known from Luzon and Mindanao.

SPECIMENS EXAMINED. **Luzon**, Isabela Province, Sitio Digoyo, 17 April 1991, *Tan* 91–108 pro parte (FH); Quezon Province, Real, National Botanical Garden, 4 August 1985, *Tan & Wijangco* 85–105 pro parte (BM).

Syrrhodon loreus is distinguishable from other species in the Calymperaceae with long leaves by the possession (in combination) of the following features: a) a sharply defined hyaline lamina (Fig.

21s); b) acute, thick-walled marginal teeth adjacent to the distal hyaline lamina (Fig. 21s, t); c) the constriction of the chlorophyllose lamina just above the hyaline base (Fig. 21q); and d) a single row of guide cells in the costa (Fig. 21u).

Syrrhodon muelleri (Dozy & Molke.) Sande Lac., *Bryol. jav.* **2**: 224 (1870).

Fig. 22a–f.

Calymperidium muelleri Dozy & Molke., *Bryol. jav.* **1**: 51 (1856). Type: Java, *Holle* s.n. (BM!-isotypes?).

Shoots up to >1.5 cm high, forming stiffly bristled tufts and mats. Stems very short, obscure. Leaves stiffly erect to erecto-patent, 6–>12 mm long, consisting of a linear chlorophyllose limb arising from a narrowly subelliptical hyaline base (limb sometimes spirally twisted when dry); apex obtuse (rarely acute), entire or with one or two small teeth (Fig. 22a, b). Costa ending in apex, usually smooth, above hyaline base sometimes some superficial cells projecting from their distal ends; internally with a single layer of guide cells (Fig. 22e); in upper leaf subtriangular in cross-section. Cells of chlorophyllose lamina quadrate to shortly rectangular or rounded-elliptical, 5–12.5 × 5–10 μm, obscured by a crown of low papillae or smooth, not protuberant (Fig. 22d, f). Leaf margin from base to near apex formed by a thick, entire, polystratose rib; above leaf shoulders terete in cross-section, consisting of a strand of stereids largely enclosed by a superficial layer of chlorophyllose cells (subrectangular in surface view) (Fig. 22d, f); below shoulders becoming flattened, superficial cells linear or undifferentiated. Gemmae sometimes produced from the ventral surface of the costal apex. Seta 11–14 mm long; capsules 1–1.4 mm long, reddish brown.

HABITAT. On tree trunks in lowland to mid-montane (c. 800 m) rainforest.

DISTRIBUTION. An Indo-Pacific species.

SPECIMENS EXAMINED. **Catanduanes**, 14 November 1917, *Ramos* 30609 (BM); **Luzon**, Isabela Province, Sitio Digoyo, 17 April 1991, *Tan* 91–108 pro parte (FH); Quezon Province, Real, National Botanical Garden, 4 August 1985, *Tan & Wijangco* 85–105 pro parte (FH); Quezon Province (Tayabas), Tagcauayan, *Foxworthy & Ramos* 13097 (BM); **Mindanao**, 1880, *Montano* s.n. (BM); *Montano* 192 (BM); **Palawan**, Mt Mantalingahan, between Nalpuan and Sandurapei, 26 April 1991, *Tan* 91–225 (BM); Palawan Province, Puerto Princesa, Barangay Irawan, Mt Malinao, 4 May 1993, *Tan* 93–336 (FH). **Sibuyan**, Magdiwang, Bo. Tampayan, Mt Giting-Giting, 21 May 1987, *Tan & Hernaez* 87–456 (FH).

Syrrhodon muelleri is distinguished from all other Malesian species by its erect, linear, largely entire leaves, with thick, subcylindrical marginal ribs composed of superficial chlorophyllose cells enclosing a core of stereids.

Syrrhodon parasiticus (Brid.) Besch. in *Ann. Sci. Nat. Bot.* sér. 8, **1**: 298 (1895).

Fig. 22g–k.

Bryum parasiticum Brid., *Muscol. recent.* **2**(3): 54 (1803). Type: Jamaica, *Swartz* s.n. (BM!-isotypes).

Syrrhodon wiemansii M. Fleisch., *Musc. Fl. Buitenzorg* **1**: 204, 210 (1904). Type: Java, Tjipannas, *Fleischer* s.n. (FH, H-isotypes?).

Calymperopsis wiemansii (M. Fleisch.) M. Fleisch. in *Biblioth. Bot.* **80**: 5 (1913).

Calymperopsis parasitica (Brid.) Broth., *Nat. Pflanzenfam.* 2nd ed., **10**: 235 (1924).

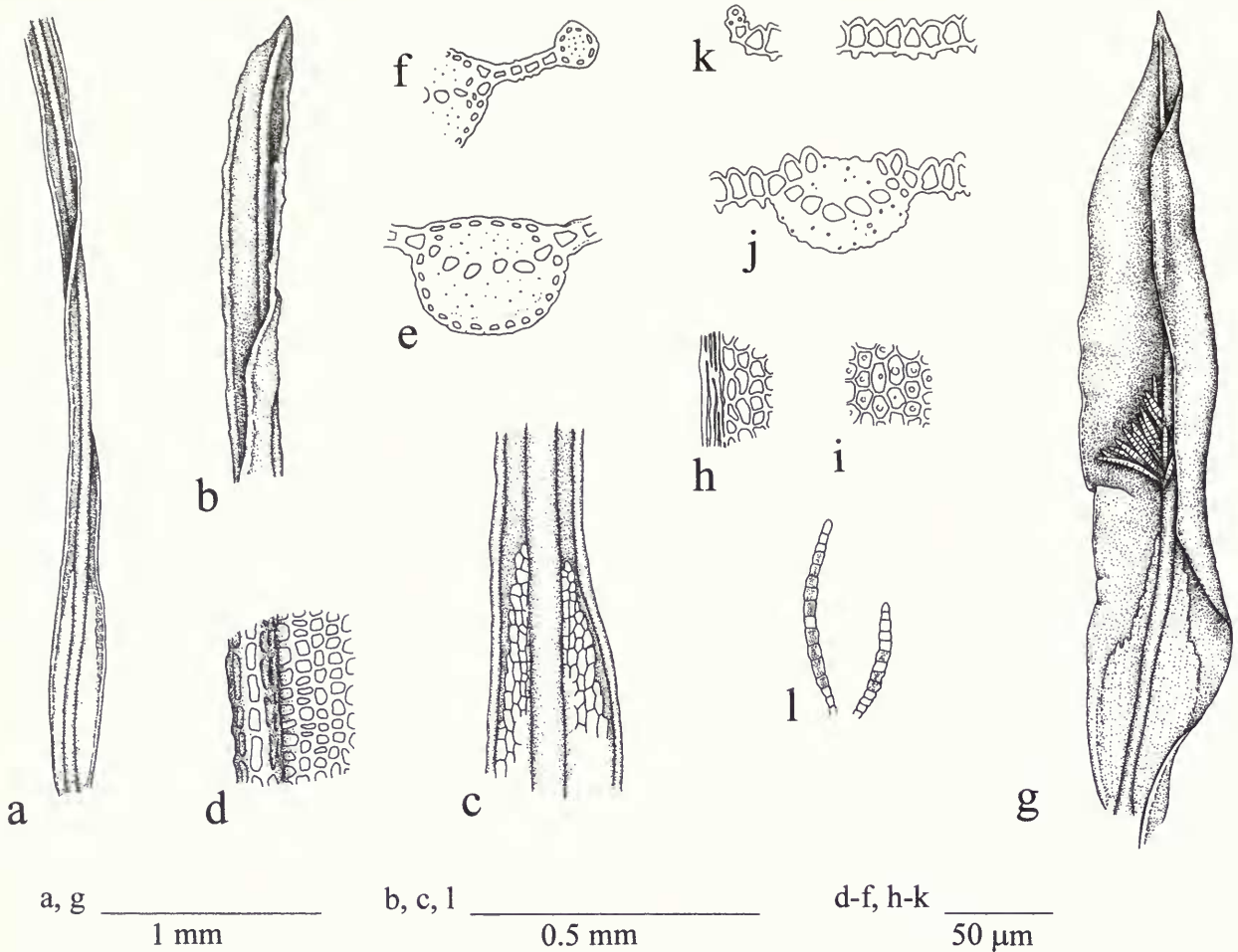


Fig. 22 a–f. *Syrrhopodon muelleri* (Dozy & Molck.) Sande Lac. a–c: leaf (detail a: from base to above mid-leaf, b: apex, c: distal hyaline base; d: cells of chlorophyllose lamina with marginal rib in surface view; e, f: cross-sections of leaf (e: costa, f: chlorophyllose lamina with marginal rib). g–k. *Syrrhopodon parasiticus* Brid. g: leaf in ventral view with gemmae; h, i: cells of leaf in surface view (h: at margin in mid-leaf, i: in chlorophyllose lamina (dorsal view)); j, k: cross-sections of leaf (j: costa, k: chlorophyllose lamina and marginal rib. a–f Drawn from Tan 91–225 (BM). g–k Drawn from Sumatra, Jacobson 11393b (BM).

Shoots 0.5–1.5 cm high, often densely matted with rhizoids below, forming mats. Leaves 3–4 mm long, consisting of an erect suboblong hyaline base narrowing slightly into a suberect to patent-reflexed (moist), lingulate to lanceolate chlorophyllose limb; leaf apex broadly acute, entire to subdenticulate (Fig. 22g). Costa ending in apex; mostly smooth with a surface largely composed of stereids; dorsal surface from just above hyaline base to midleaf (or beyond) often composed of quadrate to shortly rectangular, subacutely protuberant cells (sometimes forming only one or two rows along either side of the ventral surface in this region) (Fig. 22j). Chlorophyllose lamina often incurved; cells isodiametric to slightly longer than broad, with 4–6 sides or rounded-elliptical, 5–12.5(–15) × 5–8(–10) µm (Fig. 22i); ventrally acutely to subacutely protuberant (often tipped with a small papilla), dorsally unipapillose (Fig. 22k). Hyaline lamina sharply defined, with a long acute apex penetrating the chlorophyllose lamina. Leaf margins entire to subdenticulate; above hyaline base consisting of a thin, intermittent to continuous strand of stereids or substereids (Fig. 22h, k); in hyaline base consisting of a broad rib of linear, thin- to thick-walled cells (not continuous with strand in chlorophyllose limb but merging distally into the chlorophyllose

lamina). Gemmae long, filamentous, uniseriate (Fig. 22l); produced from rows of cells on either side of the ventral surface of the costa from slightly above the hyaline base to well beyond midleaf (Fig. 22g). Sporophytes rare, not seen in Philippine material.

HABITAT. On trunks of trees.

DISTRIBUTION. A nearly pantropical species. Tixier (1967) cites a Philippine specimen from Baguio in Luzon (as *Calymperopsis wiemansii* (M. Fleisch.) M. Fleisch.).

No other local specimens examined.

***Syrrhopodon rufescens* Hook. & Grev.** in *Edinburgh J. Sci.* 3: 227 (1826). Type: Singapore, Wallich 2271 (BM!-holotype). Fig. 23a–e.

Leucophanella rufescens (Hook. & Grev.) M. Fleisch., *Musc. Fl. Buitenzorg* 1: 200 (1904).

Shoots 1–>2 cm high, densely leaved, forming pale green cushions, often loosely matted with red rhizoids below. Leaves 1.5–>2 mm long, suberect to patent-recurved, lanceolate, 'v'-shaped in cross-

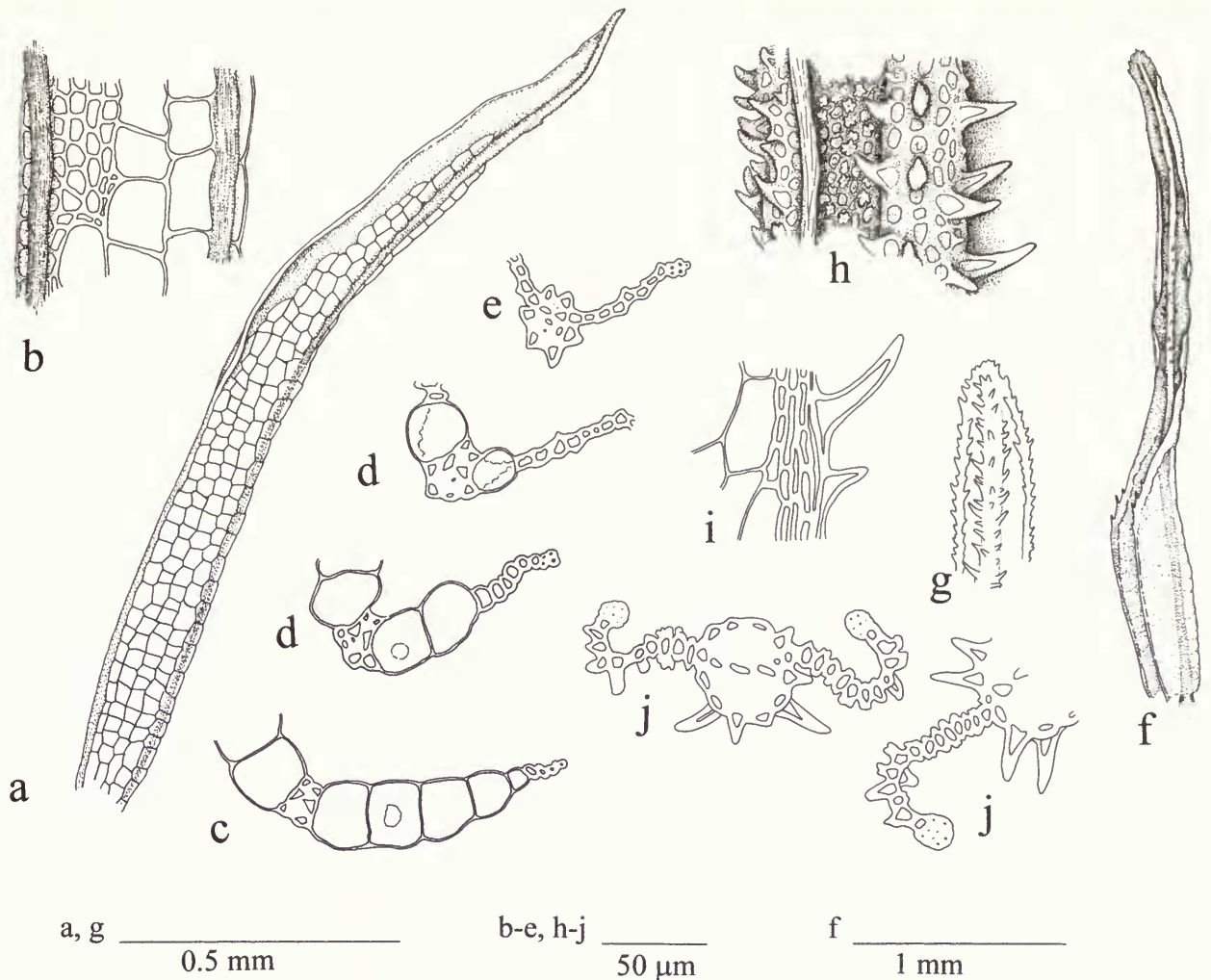


Fig. 23 a–e. *Syrrhopodon rufescens* Hook. & Grev. a, b: leaf (a: dorsal view, with b: detail of proximal chlorophyllose lamina); c–e: cross-sections of leaf in c: lower leaf, d: mid-leaf, and e: near apex. f–j *Syrrhopodon spiculosus* Hook. & Grev. f, g: leaf (f: ventral view, with g: detail of apex); h, i: cells of leaf (ventral surface) (h: in costa and blade of chlorophyllose limb, i: at margin of distal hyaline lamina); j: cross-section of chlorophyllose limb. a–e Drawn from *Elmer* 16843 (BM). f Drawn from Thailand, *Kerr* 456 (BM). g–j Drawn from Peninsular Malaysia, *Spare* 1726 (BM).

section, narrowing from above midleaf to an acute apex; largely composed of hyaline lamina (Fig. 23a). Costa thin, ending in apex, composed of a median layer of guide cells (about two cells wide) between dorsal and ventral bands of stereids, superficial cells differentiated (Fig. 23c–e), in distal leaf shortly subrectangular in surface view, many giving rise to teeth, toward leaf base elongated and smooth. Chlorophyllose lamina occupying less than one fifth of leaf length, narrowly to broadly tapering down either side of hyaline lamina, ceasing prior to midleaf, cells mostly quadrate to shortly rectangular, irregularly rounded-elliptical, mostly $6\text{--}12.5\text{--}(17.5) \times 6\text{--}10\ \mu\text{m}$ (Fig. 23b); dorsally and ventrally flat or protruding subacutely, often with an apical papilla. Hyaline lamina sharply defined, cells large, thin-walled, seldom more than about 5–6 rows on either side of the costa. Leaf margins often recurved for a short distance above midleaf; from leaf base to apex entire, consisting of a narrow, smooth unistratose or bistratose strand of stereids. Seta red, smooth, c. 6–8 mm long; capsule erect, shortly cylindrical, c. 1 mm long, yellowish brown with a red rim; operculum long-rostrate; peristome teeth c. 150 μm long, usually with papillose longitudinal striations.

HABITAT. On trees in lowland forest.

DISTRIBUTION. A Malesian species.

SPECIMEN EXAMINED. Luzon, August 1916, *Elmer* 16843 (BM, BM-K).

Eddy (1990) points out the strong similarity between *Syrrhopodon rufescens* and *S. involutus*. At least one Philippine specimen (*Elmer* 16843) possesses the features apparently definitive of *S. rufescens* and is separable from the locally collected material of *S. involutus*. However, the relationship between these taxa needs further study using fresh material with peristomes in a good condition..

Syrrhopodon spiculosus Hook. & Grev. in *Edinburgh J. Sci.* 3: 226 (1825). Type: Singapore, *Wallich* [83 (H.1207)] (BM!-holotype; BM!-isotype).

Fig. 23f–j.

Shoots mostly 1–3(–4) cm high. Leaves 2–>4 mm long, consisting of an erect, narrowly elliptical, semisheathing hyaline base rapidly narrowing distally into a patent to spreading linear chlorophyllose limb with a blunt, dentate apex (Fig. 23f, g). Costa ending just below

apex; above hyaline leaf base on dorsal and ventral surfaces with long, distally pointing, acute spines (often in subtransverse rows) (Fig. 23h). Cells of chlorophyllose lamina isodiametric to longer than broad, with 4–6 sides or rounded-elliptical, mostly 5–12 × 5–8 µm; drawn out dorsally and ventrally as erect, coronate-papillose projections (towards leaf apex often becoming more spinose and curving distally) (Fig. 23h, j). Hyaline lamina sharply defined. Leaf margins towards and at apex dentate; from above shoulders of leaf to a short distance below apex often incurved, consisting of an entire polystratose rib of stereids (Fig. 23h, j); from around shoulders of leaf to base composed of a flattened band of thick-walled, linear cells (continuous with rib in upper leaf), at shoulders giving rise to a row of long, acute spines (Fig. 23i), below shoulders entire. Sporophytes rare. Seta > 7 mm long; capsule cylindrical, c. 1–1.5 mm long.

HABITAT. On decaying logs, and trunks and twigs of trees in damp, shaded situations at low altitude.

DISTRIBUTION. A palaeotropical species with sporadic distribution. Reported for the Philippines by Bartram (1939), as a single collection from Panay.

No other local specimens examined.

Syrrhopodon tjibodensis M. Fleisch., *Musc. Fl. Buitenzorg* **1**: 209 (1904). Type: Java, Tjibodas, 1450 m, September 1899, *Fleischer (Musci Frond. Arch. Ind., ser. VI, exs. no. 261)* (BM!-isotype). Fig. 24j–n.

Syrrhopodon bartlettii E.B. Bartram in *Philipp. J. Sci.* **68**: 82 (1939). Type: Philippines, Luzon, Mountain Prov., Baguio, 25 March 1935, *Bartlett 13331* (FH!-holotype).

Calymperopsis tjibodensis (M. Fleisch.) M. Fleisch. in *Biblioth. Bot.* **80**: 5 (1913).

Shoots 0.5–1.5 cm high, densely leaved, forming dense mats. Leaves erect to spreading (moist), mostly 2–3.5 mm long, consisting of a shortly subrectangular hyaline base that narrows slightly distally into a broadly linear-lanceolate chlorophyllose limb (often curved (inner edge ventral) and/or longitudinally folded, i.e. 'v'-shaped in cross-section) (Fig. 24j); apex narrowly to broadly acute or apiculate, entire or with 1–2 small teeth. Costa ending in apex, smooth, dorsal and ventral surfaces formed by stereids (Fig. 24n). Cells of chlorophyllose lamina isodiametric to slightly longer than broad, with 4–6 sides or rounded-elliptical, mostly 7.5–15 × 7.5–11 µm; dorsally and ventrally slightly protuberant and strongly pleuripapillose (papillae often obscuring outlines of cells) (Fig. 24m, n). Hyaline lamina sharply defined with a somewhat truncate apex (Fig. 24k, l). Leaf margins entire, adjacent to apex of hyaline lamina often narrowly recurved (Fig. 24l); from below base of chlorophyllose limb to near apex consisting of a narrow rib of stereids (Fig. 24n); from between distal and mid-hyaline base to insertion composed of a flattened band of linear, thick-walled cells (about 3–5 cells wide, continuous with rib in upper leaf). Gemmae (fusiform-clavate) often produced from the ventral surface of the costa shortly above the apex of the hyaline lamina (Fig. 24k). Sporophytes apparently unknown.

HABITAT. On trunks of trees.

DISTRIBUTION. China, Indonesia (Java), Philippines. Bartram (1939) cites a specimen from Luzon (as *Syrrhopodon bartlettii*, see above).

SPECIMEN EXAMINED. Palawan, St Paul Bay, St. Paul Subterranean National Park, 25 May 1989, *Tan 89-1361* (FH).

Syrrhopodon tjibodensis is very similar to *S. parasiticus*, but is most easily distinguished by the possession of pleuripapillose cells forming the chlorophyllose lamina (Fig. 24m, n). In *S. parasiticus* these cells are ventrally protuberant (sometimes with a single papilla) and dorsally unipapillose (Fig. 22i, k).

Syrrhopodon trachyphyllus Mont., *Syll. Gen. Sp. Crypt.* **47** (1856).

Type: Singapore, *Gaudichaud*, Hb. Montagne (BM!-isotypes). Fig. 24a–i.

Syrrhopodon semperi Müll. Hal. in *Linnaea* **38**: 557 (1874). Type: Philippines, Luzon, 1861, *Semper s.n.* (BM!-isotype).

Shoots <0.5–1.5 cm high, forming dense, low mats. Stems sometimes thickly matted with rhizoids towards base. Leaves about 2–3 mm long, consisting of a short, slightly tapering, broadly linear-rectangular, suberect to patent (when moist) chlorophyllose limb extending from a suberect, shortly oblong hyaline base; apex obtusely pointed to subcucullate (Fig. 24a–c). Costa ending just below or in apex, smooth; formed by dorsal and ventral strands of stereids separated by a unistratose layer of guide cells, superficial cells not differentiated (i.e. surface formed by stereids) (Fig. 24h). Cells of chlorophyllose lamina mostly isodiametric to slightly longer than broad, with 4–6 sides, 10–15(–17.5) × 8–12.5 µm (Fig. 24g); ventrally protruding subacutely and crowned with papillae; dorsally flat to slightly convex, with a crown of papillae (Fig. 24i). Hyaline lamina sharply defined. Leaf margins at leaf apex denticulate; above hyaline base to near leaf apex often erect to incurved, with a thin (often intermittent), usually entire polystratose rib composed of stereids (Fig. 24i); adjacent to apex of hyaline lamina becoming unistratose, often weak, sometimes giving rise to acute teeth or spines (Fig. 24e, f); in leaf base entire, formed by a flattened band of linear, thick-walled cells (Fig. 24d).

Sporophytes not seen.

HABITAT. Mostly on tree trunks, sometimes on rock.

DISTRIBUTION. A palaeotropical species. In the Philippines, apparently confined to Luzon.

No local specimens examined, apart from the type of *Syrrhopodon semperi*.

For a comparison of this species with *Syrrhopodon armatus* see under the description of the latter.

Eddy (1990) illustrates two specimens with different features as *Syrrhopodon trachyphyllus*. One has features which conform to the above description and match those of the type specimen, the second possesses costae with a superficial layer of papillose chlorophyllose cells and cells in the chlorophyllose lamina apparently narrower than those described above. The material on which the latter illustration is based may not represent *S. trachyphyllus* and plants with its features have yet to be recorded for the Philippines.

Syrrhopodon tristichus Nees ex Schwägr., *Sp. musc. frond. suppl.* **4**: 311b (1842). Type: Java, Hb. Nees (BM!-isotypes). Fig. 24o–t.

Syrrhopodon macrotristichus Broth. in *Leaflet Philipp. Bot.* **2**: 652 (1909). Type: Philippines, Luzon, Lucban, Tayabas Province, May 1907, *Elmer 7713* (BM!-isotype, NY-isotype).

Syrrhopodon victorianus E.B. Bartram in *Bernice P. Bishop Mus. Occ. Pap.* **19**(11): 222 (1948). Type: Fiji, Viti Levu, Mount Victoria, *Greenwood 1159* (FH-holotype).

Shoots 2–9 cm long, slender, occasionally branched, often matted

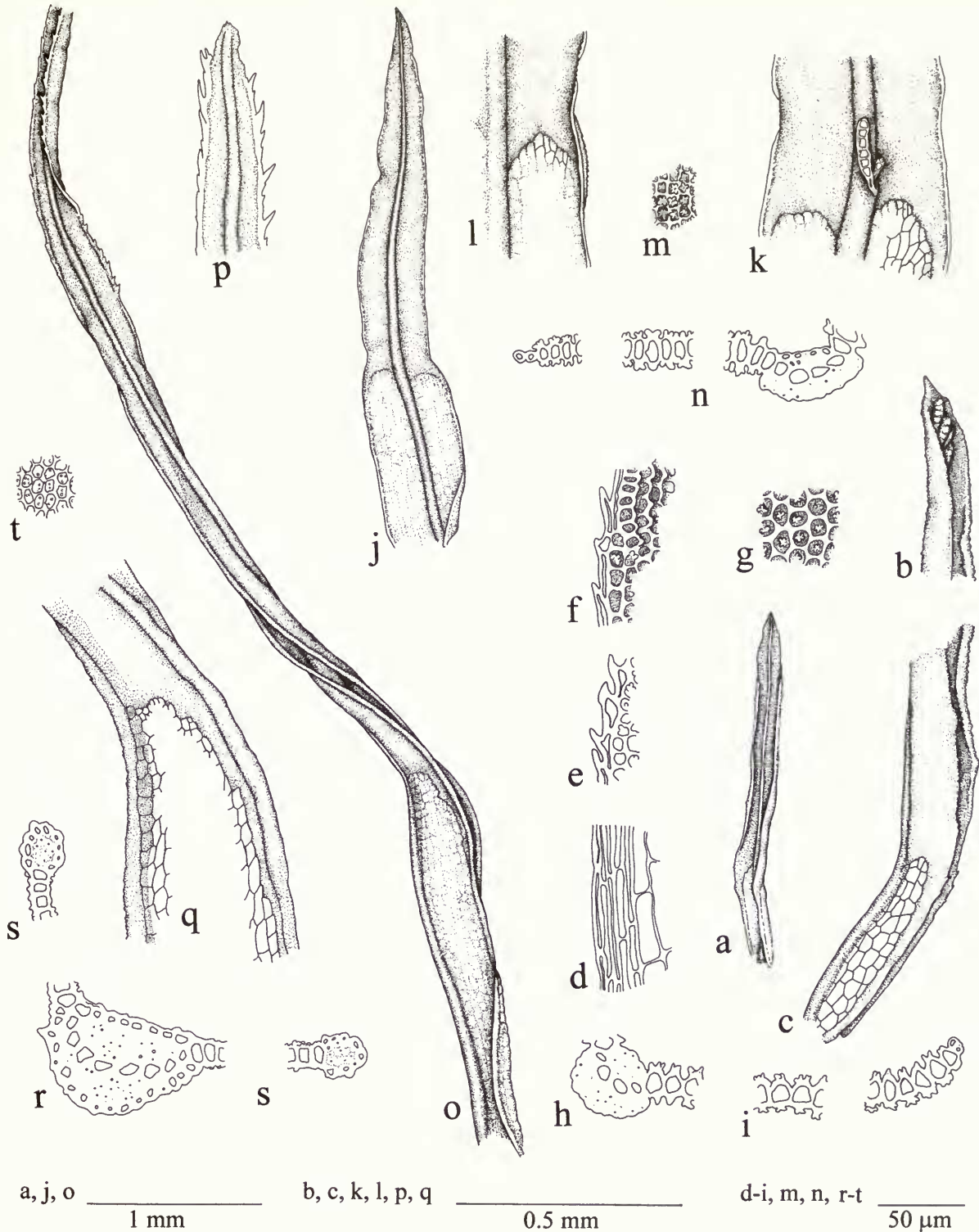


Fig. 24 a–i. *Syrrhodon trachyphyllus* Mont. a–c: leaf (a: in ventral view, with details of b: apex in ventral view with gemmae, and c: of lower leaf); d–g: cells of leaf in surface view (d: at margin in proximal hyaline base, e, f: at margin adjacent to apex of hyaline lamina, g: in chlorophyllose lamina); h, i: cross-sections of leaf (h: costa, i: chlorophyllose lamina and marginal rib). j–n. *Syrrhodon tjibodensis* M. Fleisch. j–l: leaf (j: in ventral view, with detail of region around apex of hyaline lamina k: in ventral view with gemmae, and l: in dorsal view showing recurved margin); m: cells of chlorophyllose lamina in surface view; n: cross-section of chlorophyllose limb. o–t. *Syrrhodon tristichus* Nees ex Schwägr. o–q: leaf (o: in lateral view, with details of p: apex, q: distal hyaline base); r, s: cross-sections of leaf (r: costa, s: chlorophyllose lamina and marginal rib); t: cells of chlorophyllose lamina in surface view. a–d, f–i Drawn from Sarawak, *Bell* 2008 (BM). e Drawn from *Semper* s.n. (BM). j–n Drawn from *Tan* 89–1361 (FH). o–t Drawn from *Price* s.n. (FH).

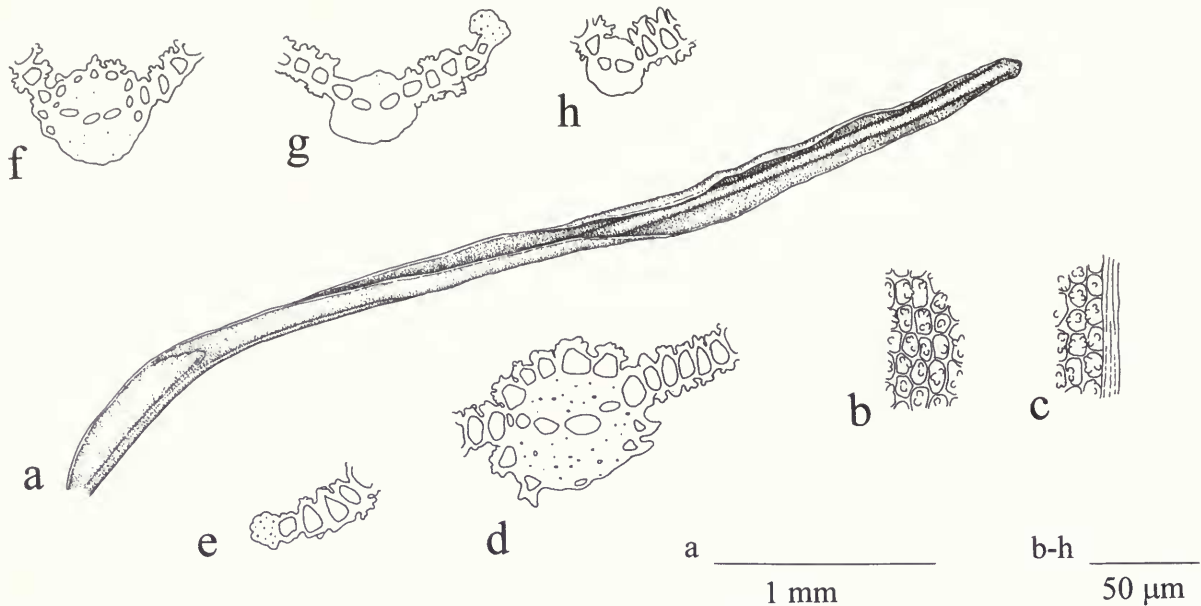


Fig. 25 a–e. *Syrrhopodon prolifer* var.? a: leaf; b, c: details of leaf surface (b: in chlorophyllose lamina, c: at margin of chlorophyllose lamina); d, e: cross-sections of chlorophyllose limb (d: costa, e: margin). f. *Syrrhopodon prolifer* var. *papillosum* (Müll. Hal.) W.D. Reese f: cross-section of costa in chlorophyllose limb. g. *Syrrhopodon prolifer* var. *albidus* (Thwait. & Mitt.) S. Orbán & W.D. Reese g: cross-section of chlorophyllose limb. h. *Syrrhopodon prolifer* var. *tosaensis* (Cardot) S. Orbán & W.D. Reese h: cross-section of costa in chlorophyllose limb. a–e Drawn from Tan & Hernaez 87–507 (BM). f Drawn from Venezuela, Funcke & Schlim 358 (BM). g Drawn from Sri Lanka, Thwaites 53 (BM). h Drawn from Japan, Iwatsuki, Sharp & Sharp 1044 (BM).

with rhizoids below. Leaves in three lax ranks (obscured by flexing of leaf limbs when dry), 4–11 mm long, bristle-like, mostly patent to recurved from an erect, long, narrowly oblong hyaline base; apex dentate, long and finely drawn out (Fig. 24o, p). Costa ending just short of leaf apex; superficial cells shortly to long rectangular, mostly smooth and flat, or with slightly projecting distal ends, sometimes forming teeth close to leaf apex; internally with a single row of guide cells between dorsal and ventral layers of stereids (Fig. 24r). Chlorophyllose lamina incurved to above mid-limb, forming a channel; composed of quadrate to subrectangular or irregularly rounded to elliptical, thick-walled cells, isodiametric or longer than broad, 8–17(–20) × 6–10 mm (Fig. 24t), each with a crown of low papillae on the dorsal and ventral surfaces (sometimes poorly developed) (Fig. 24s). Marginal ribs strong, continuous from leaf base to shortly below apex, a polystratose band of stereid or substereid cells; in proximal leaf base flattened and entire; around shoulders of leaf becoming thicker and more rounded in section (commonly reaching 30–38 mm wide); from above shoulders towards leaf apex gradually becoming thinner and more flattened (Fig. 24s); distally (from about mid-limb) giving rise to acute, forward pointing, often double teeth, towards leaf apex these are usually more closely set and more commonly single.

Sporophytes uncommon; seta 6–7 mm long; capsule 1.5–1.8 mm long.

HABITAT. Mostly occurring on tree trunks in rainforest.

DISTRIBUTION. A palaeotropical species.

SPECIMENS EXAMINED. **Basilan**, *Semper* s.n. (in Hb. Hampe, BM). **Luzon**, Rizal Province, April 1914, *Loher* 15164 (BM). **Mindanao**, Agusan Norte Province, Mt Hilong-Hilong, May–June 1984, *Tan & Navarez* 84–503 (BM). **Mindoro**, Baco, Mt Halcon, 17 April 1987, *Tan* 87–117 (BM); 18 April 1987, *Tan* 87–136 (BM). **Negros**, Negros Oriental Province, Dumaguete, Cuernos Mts, June 1908, *Elmer* 9768 (BM); May 1908, *Elmer* 9886 (BM). **Palawan**,

Motley s.n. (in Hb. Hooker, BM-K). **Panay**, Mt. Madyaas, 15–16 January 1987, *Price* s.n. (FH). **Sibuyan**, northern slope of Mt Giting Giting, near Mayo's Peak, 22 May 1987, *Tan & Hernaez* 87–509 (FH).

The leaves of *Syrrhopodon tristichus* have a superficial resemblance to those of *S. flammeonervis* Müll. Hal. In the latter the surface of the costa is undifferentiated, composed of stereids (Fig. 19f); in *S. tristichus* the costa possesses a superficial layer of rectangular chlorophyllose cells (surface view).

Excluded taxa

Mitthyridium luteum (Mitt.) H. Rob. – See under *M. papuanum*.

Mitthyridium undulatum (Dozy & Molke.) H. Rob. – There are no reliable records of *M. undulatum* from the Philippines. The specimens cited under this name by Bartram (1939) have subsequently been redetermined, mostly as *Mitthyridium fasciculatum*.

Three other taxa, *Calymperes crassinerve* (Mitt.) A. Jaeger*, *Mitthyridium junquilianum* (Mitt.) H. Rob.* and *Syrrhopodon prolifer* var. *albidus* (Thwait. & Mitt.) S. Orbán & W.D. Reese* have had the Philippines either mentioned in the discussion of a species range, or included in maps showing the geographical range of a species (Mohamed & Reese, 1985; Reese, 1987a, 1987b; Reese, Mohamed & Mohamed, 1986). There is no mention of a definitive Philippine specimen in these publications. Although the distribution pattern of these species suggests a high probability of their occurrence in the Philippines, we have opted to exclude them in this treatment owing to the lack of a voucher specimen documenting their presence in the country.

Syrrhopodon prolifer Schwägr. var. ? – *Syrrhopodon prolifer*, with its many varieties, was revised by Orbán & Reese (1990). A collection from Sibuyan Island, *Tan & Hernaez* 87–507 (BM), resembles a small form of the neotropical endemic *S. prolifer* var. *papillosum*

(Müll. Hal.) W.D. Reese. Shoots of *Tan & Hernaez* 87–507 have erect to recurved, green, linear leaves, about 3–5 mm long. The cells forming the ventral surface of the costa above the hyaline base are subquadrate to shortly subrectangular or rounded (in surface view) with compound papillae (Fig. 25d); cells in the chlorophyllose lamina (mostly 10–18(–22.5) × 10–12.5(–15) µm) are similarly crowned on their dorsal and ventral surfaces with compound papillae (Fig. 25b, e). The leaf margins adjacent to the apex of the hyaline lamina are entire to distantly denticulate. *Syrrhopodon prolifer* var. *papillosus* possesses erect to recurved, linear leaves, up to >7 mm long with a reddish brown costa. The cells forming the ventral surface of the costa above the hyaline base (Fig. 25f), and those forming the chlorophyllose lamina, are similar to those in *Tan & Hernaez* 87–507 (except the cells of the chlorophyllose lamina have slightly thicker walls). The leaf margins adjacent to the apex of the hyaline lamina are most often entire.

Syrrhopodon prolifer var. *albidus* (Thwait. & Mitt.) S. Orbán & W.D. Reese and *S. prolifer* var. *tosaensis* (Cardot) S. Orbán & W.D. Reese have an Asian distribution. In these varieties (and most others) the ventral surface of the costa is smooth (except at the leaf apex) and composed of stereids (Fig. 25g, h). Leaves of var. *tosaensis* are about 2–4 mm long, generally smaller than those in *Tan & Hernaez* 87–507, but possess similar laminal papillae. According to Orbán & Reese (1990), in var. *tosaensis*, the leaf margins adjacent to the apex of the hyaline lamina are consistently toothed. In var. *albidus* the leaves are 3–6 mm long, with entire leaf margins. The cells of the chlorophyllose lamina are similar in size and ornamentation to those of *Tan & Hernaez* 87–507, but are relatively thick-walled.

Tan & Hernaez 87–507 cannot be readily identified as any of the presently recognized varieties of *Syrrhopodon prolifer*. However, the authors are reluctant to describe a new variety on the basis of a single specimen.

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REFERENCES

- Akiyama, H. & Reese, W.D. 1993. Taxonomic studies of mosses of Seram and Ambon (Moluccas, East Malesia) collected by Indonesian-Japanese botanical expeditions. VI Calymperaceae. *Journal of the Faculty of Science, University of Tokyo*, Section III, 15(3): 199–218.
- Bartram, E.B. 1939. Mosses of the Philippines. *Philippine Journal of Science* 69(1–4): 1–425.
- Eddy, A. 1990. *A handbook of Malesian mosses*. 2. London.
- Edwards, S.R. 1980. Spore discharge in *Calymperes*. *Journal of Bryology* 11: 95–97.
- Ellis, L.T. 1987. Taxonomic notes on *Calymperes*. *Journal of Bryology* 14: 681–690.
- 1988. Taxonomic notes on *Calymperes* II. *Journal of Bryology* 15: 127–140.
- 1989. A taxonomic revision of *Calymperes* in southern India and neighbouring islands. *Journal of Bryology* 15: 697–732.
- 1991. *Calymperes schmidtii* Broth. in J. Schmidt and C. subintegrum Broth. in J. Schmidt, two distinct species from Malesia. *Journal of Bryology* 16: 589–593.
- Iwatsuki, Z. & Tan, B.C. 1979. Checklist of Philippine mosses. *Kalikasan, The Philippine Journal of Biology* 8(2): 179–210.
- 1980. Noteworthy Philippine mosses at the Hattori Botanical Laboratory (NICH), Japan. *Kalikasan, The Philippine Journal of Biology* 9(2–3): 267–282.
- Menzel, M. & Schultze-Motel, W. 1990. The bryophytes of Sabah (North Borneo) with special reference to the BRYOTROP transect of Mount Kinabalu. XI Calymperaceae (Bryopsida). *Willdenowia* 19: 475–542.
- Mohamed, H. & Reese, W.D. 1985. *Syrrhopodon* (Musci: Calymperaceae) in Malaysia and adjacent regions. *Bryologist* 88: 223–254.
- 1992. *Syrrhopodon stonae*, new to Malaya, and notes on other Malayan Calymperaceae. *Bryologist* 95(1): 88–91.
- Müller, C. 1856. Review of: Dozy, F & Molkenboer, J.H. 'Bryologia javanica.....'(Fascicle VI: 1855, Fascicle VII–X: 1856). *Botanische Zeitung* 15: 530–535.
- Nowak, H. 1980. *Mitthyridium* in Ozeanien. *Bryophytorum Bibliotheca* 20: 1–236.
- Orbán, S. & Reese, W.D. 1990. *Syrrhopodon prolifer* (Musci: Calymperaceae): a world view. *Bryologist* 93(4): 438–444.
- Reese, W.D. 1987a. *Calymperes* (Musci: Calymperaceae): world ranges, implications for patterns of historical dispersion and speciation, and comments on phylogeny. *Brittonia* 39: 225–237.
- 1987b. World ranges, implications for patterns of historical dispersal and speciation, and comments on phylogeny of *Syrrhopodon* (Calymperaceae). *Memoirs of the New York Botanical Garden* 45: 426–445.
- 1993. Calymperaceae. *Flora Neotropica* 58: 1–102.
- 1994. The subgenera of *Mitthyridium* (Musci). *Journal of the Hattori Botanical Laboratory* 75: 41–44.
- & Bartlett, J.K. 1982. *Syrrhopodon fimbriatulus* C. Müll., and the family Calymperaceae (Musci), new to New Zealand Island Territories. *Journal of Bryology* 12: 209–214.
- Koponen, T. & Norris, D.H. 1986. Bryophyte flora of the Huon Peninsula, Papua New Guinea. XIX. *Calymperes*, *Syrrhopodon*, *Mitthyridium* (Calymperaceae, Musci). *Acta Botanica Fennica* 133: 151–202.
- & Mohamed, H. 1985. A synopsis of *Calymperes* (Musci: Calymperaceae) in Malaysia and adjacent regions. *Bryologist* 88: 98–109.
- & Mohamed, A.D. 1986. A synopsis of *Mitthyridium* (Musci: Calymperaceae) in Malaysia and adjacent regions. *Bryologist* 89: 49–58.
- & Stone, I.G. 1987. New records of Australian Calymperaceae and keys to Australian species of *Calymperes*, *Mitthyridium* and *Syrrhopodon*. *Journal of Bryology* 14(3): 487–494.
- 1995. The Calymperaceae of Australia. *Journal of the Hattori Botanical Laboratory* 78: 1–40.
- & Streimann, H. 1994. *Calymperes subserratum* (Musci), new to eastern Malesia, with notes on *C. serratum* and *C. subulatum*. *Bryologist* 97(1): 80–82.
- Tan, B.C. 1996. Biogeography of Palawan mosses. *Australian Systematic Botany* 9: 193–203.
- & Iwatsuki, Z. 1991. A new annotated Philippine moss checklist. *Harvard Papers in Botany* 3: 1–64.
- Tixier, P. 1967. Le genre *Calymperopsis* (C. M.) Fleisch. (Calymperaceae). *Revue Bryol. Lichénol.*, N.S. 35(1–4): 265–302.

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